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THE primary value of a periodical like the *Railway Mechanical Engineer* lies in the use which is made of each issue immediately after its publication. Much of the material in each issue, however, possesses more or less of permanent value to be drawn upon at times when various subjects come up for special study, or the solution of special problems demands intensive application. To take full advantage of the permanent value of the material contained in the pages of a year's issues, these pages must be saved. Unless you are clipping each issue and filing, by subjects, those articles which you believe may be useful for future reference, why not keep your issues intact and use the index printed for each year's volume of twelve issues? The 1928 index will soon be ready for mailing. Copies are sent to any of our subscribers who wish to receive them. If you wish a copy of the index, place your order with our circulation department without delay. If you wish to receive it each year and will so state in your letter to the circulation department, we shall gladly place your name on a permanent list of those to whom copies will be mailed regularly.

Cut Journals Expensive

ALMOST every one connected with the operation of a railroad knows that hot and cut journals under freight cars are costly, but it is doubtful if many realize how serious this expense is. If reasonably accurate figures could be developed to show the cost of delays to freight trains, setting out cars, moving cars to and from repair tracks, destruction of property, changing wheels, car detention and consequential claims on account of hot boxes or cut journals, they would, no doubt, reveal expenses far beyond anything ordinarily imagined. In one large terminal alone, an average of 1,200 pairs of wheels are changed each month on account of cut journals, the great majority of which are removed from loaded cars, resulting in each car being delayed an average of about 24 hours. This refers only to cars found with cut journals in interchange, and does not include the many wheels changed on cars within the territory of this terminal that are not interchanged from one road to another. With such a situation at one terminal, it is safe to say that many thousands of wheels are changed monthly throughout the United States for the same reasons. Space does not permit going into details in this editorial regarding causes and remedies. Suffice to say that all intelligent car men in direct contact with car maintenance and operation know what is necessary to improve the situation. They realize that more thorough workmanship in wheel shops is only one requisite. It must be accompanied by closer inspection, greater care in the assembly of journals, brasses and boxes and an energetic campaign of education in proper methods of packing boxes and lubricating journals. A knowledge of correct methods alone is not sufficient. By some means, car department forces must be made to realize the great cost of hot boxes and cut journals and be inspired to do everything that they possibly can do to reduce this serious drain of railroad resources.

Materials, Methods and Facilities

THE introduction of lacquer finishes and the spray method of applying finishing materials has at one and the same time simplified the problem of repairing passenger equipment and brought to light new factors which, at the outset, seem to present real obstacles to the adoption of these new materials and methods. The spray method of finishing came into prominence with the introduction of lacquer finishes and has since demonstrated in many instances that it offers just as efficient and a more economical way of applying the conventional color and varnish finishes that have been used for many years. Lacquer, because of its ease of application and saving in shop time because of its rapid drying qualities, has offered the car department officer a means of reducing the cost of maintenance by cutting down out-of-service time on passenger cars and, as it now appears possible, by effecting an extension of the time between shoppings for general repairs because lacquer is more durable.

To those who must deal with the problem of passenger car repairs there are three courses open with respect to finishing of cars: To continue to apply the color and varnish finish by means of the brush; to take advantage of the time-saving element by applying these materials with the spray instead of the brush, or to adopt the lacquer finish. Unfortunately the practice of spraying nitro-cellulose finishes has introduced the question of the fire hazard to such an extent that some roads have been obliged to postpone the adoption of this type of finish on other than an experimental basis because of the fact that existing facilities are not properly adapted to its

safe use. To build new facilities or to install adequate equipment in order to comply with safety and insurance regulations might, in many cases, offset any economies anticipated by the introduction of the new materials and methods. The problem, then, seems to resolve itself into one of deciding whether or not the volume of passenger-car repair work warrants the installation of adequate shop facilities to enable a road safely to adopt the new finishes and methods. If a road has equipment enough and the demand for speedier schedules is acute enough, the indications are that the use of lacquer and the spray will result in economies in maintenance greatly in excess of any added expense due to the necessity of providing modern paint shop facilities.

Unwillingness to adopt new ideas should never be allowed to stand in the path of progress. The new methods in the field of equipment painting are distinctly steps in the right direction. The hazard of fire is the principal obstacle to the adoption of these new methods in many cases. Inasmuch as the elimination of this hazard indicates the necessity of changing the nature of shop facilities it seems that now is an opportune time to give serious consideration to the whole subject of passenger car repairs. By viewing impartially the new methods and materials it is possible that an engineering study of the problem may show the way to a new type of facilities that will result in economies in repair work that are not apparent in the light of existing conditions and equipment.

Fatalities from Crown-sheet Failures

DURING the fiscal year ending June 30, 1923, the Bureau of Locomotive Inspection inspected 63,657 locomotives and found 41,150 locomotives or 65 per cent of the total inspected, defective. Of those found defective, 7,075 locomotives were ordered out of service. During that period, there occurred 1,348 accidents, which resulted in the death of 72 persons and the serious injury of 1,560 others. The percentage of defective locomotives that year reached the highest point ever recorded. Since 1923, the number of locomotives found defective by the federal inspectors, has decreased an average of eight per cent each year, with a corresponding decrease in the number of accidents.

The annual report of A. G. Pack, chief inspector of locomotives, to the Interstate Commerce Commission, an abstract of which is published elsewhere in this issue, shows that during the fiscal year ending June 30, 1928, out of a total of 100,415 locomotives inspected, only 24,051, or 24 per cent, were found defective and of this number, only 1,725 were ordered out of service. This is the best record that has so far been attained.

A total of 419 accidents occurred during the twelve months covered by the Bureau's latest report. These resulted in 30 fatalities and injuries to 463 persons. Of these 419 accidents, 22 were boiler explosions of which 15 were crown sheet failures due to low water, for which no contributory causes were found, and seven were crown sheet failures, also due to low water, but for which contributory causes or defects were found. Sixteen deaths and 25 injuries were caused by the first classification of crown sheet failure named, and four deaths and 12 injuries were caused by the second. No accidents have been reported as being due to firebox failures such as defective staybolts, crown stays or sheets, since 1925.

The 22 accidents due to crown sheet failures constitute only a little over 5 per cent of the 419 accidents reported. They were, however, the cause of 20 of the 30 fatalities caused by all classes of accidents, and this high proportion of the loss of life justifies giving special attention to their elimination.

The bureau itself has devoted a large amount of attention during the past few years to this subject and has brought about a marked improvement in water-level recording devices. The effect of these improvements may be traced in the records of accidents caused by crown sheet failures due to low water, with contributory causes or defects found. In 1924 the number of such accidents was 22; in 1925, 13; in 1926, 15; in 1927, 5, and in 1928, 7. There has been no such decline in the number of crown sheet failures due to low water where no contributory causes were found. The largest number of accidents in this classification during the five years just closed was 22 in 1926, and 15 such accidents occurred last year.

Is it not possible that steam failures or cases of poor steaming may play an appreciable part in keeping up the number of such accidents where no contributory causes are found? In such cases the engine crew is forced to trade water for steam in order to get over the road, with a resulting decrease in the margin of safety in the water level. The smaller this margin of safety becomes, the greater becomes the probability of serious consequences from poor judgment on the part of the crew.

It would be Utopian to expect twelve months to go by with no defective locomotives, no accidents or no casualties. Undoubtedly there is an "irreducible minimum" as to the number of defective locomotives below which it is practically impossible to go. Still, taking all factors into consideration, it is not asking too much of all mechanical department officers to give more attention to the quality of maintenance being given locomotives, especially at engine terminals. Perhaps a little more intensive effort to remove all causes of poor steaming engines may have an appreciable effect in reducing the number of crown sheet failures due to low water, which will go far toward eliminating fatalities resulting from failures of steam locomotives and their appurtenances.

Last Year's Achievements in the Mechanical Department

THE year 1928 was in several respects a remarkable one in the railroad field. After a disappointing start, continuing during the first six months, in which all traffic declined below the amount handled during corresponding months in 1927, conditions changed for the better and, during the latter half of the year, the losses incurred during the first half were completely regained so far as freight traffic was concerned. The railroads thus handled approximately 475 billion net ton-miles during the entire year as compared with 474.7 billion net ton-miles in 1927. Passenger traffic, however, declined steadily throughout the year, the loss in passenger miles as compared with 1927 amounting to over 6 per cent.

All railroad men, and certainly all officers and supervisors in the equipment department, may be proud of the efficiency with which the operations of the railroads were conducted during 1928. With approximately the same total volume of revenue freight traffic and a declining volume of passenger traffic, operating expenses were so well under control that the operating ratio for the year was 72.6 per cent as compared with 74.1 per cent in 1927.

What part have the motive power and car departments played in producing this splendid result? They maintained the motive power in the best average condition of any year since the war. The highest percentage of locomotives in or awaiting shop reported during the first ten months of the year was 15.5 as compared with 16.2, the highest percentage during the preceding calendar year. In maintaining power in this highly serviceable condition fewer locomotives received both classified and running repairs than during the preceding year. Freight cars were also maintained in practically the same condition, so far as the percentage available for service is concerned, as during 1927, with but slight increases in the maximum and minimum percentages of cars unserviceable. As was the case with locomotives, fewer freight cars were turned out of the shops with both heavy and light repairs than during the preceding year.

Number of Employees Reduced

Most significant of the part played by the motive power and car departments in reducing operating expense, however, is the trend in the number of men employed in the maintenance of cars and locomotives. This trend is not a matter of the past year alone, but has been continuing steadily since 1924. In January of that year 123,500 carmen in all groups were employed by the railroads. At the beginning of 1928 slightly less than 99,700 carmen were on the payrolls, the reduction up to the beginning of last year being approximately 19 per cent. A similar reduction of 19 per cent had also been made during the same period in all classes of laborers about shops, enginehouses, power plants and stores, bringing the number on the payrolls at the beginning of 1928 down to 92,700. Another large group of employees is the skilled trade helpers. This group during the same period has been reduced from 121,300 to 102,500, or slightly more than 17 per cent. Among the skilled trades, the number of machinists was reduced from 64,600 to 56,800, or 15 per cent; boiler makers, from 21,100 to 17,300, or over 21 per cent, and blacksmiths, from 9,600 to 8,000, or 18 per cent since the beginning of 1924.

This indicates what has been accomplished by the motive power department in reducing equipment maintenance expenses during the four years preceding 1928. The latest Interstate Commerce Commission reports concerning the number of railway employees are for last September. These show a continuance of reductions in most classes of labor, varying from two to more than five per cent. There is one notable exception, however, and that is in the number of carmen, which increased by about 400 from January to September of last year.

To attribute this highly satisfactory performance to the year 1928, however, is not fair to the performances of former years. The relatively low expenditures now required to maintain both cars and locomotives are in reality the result of the general program of heavy rebuilding and otherwise thorough maintenance which was inaugurated in 1923. While some of the reductions which have since been effected may, no doubt, be attributed to improvements in the efficiency both of personnel, shop equipment and practices, it is undoubtedly true that equipment at present possesses a much higher reserve of serviceability accumulated during these years of rebuilding and rehabilitation, of which the railroads are now reaping the benefit.

In the matter of orders for freight cars and locomotives in the United States, 1928 was the poorest year since 1921. Orders for a total of only 51,200 freight cars and but 603 locomotives were placed for service in the United States. In Canada, however, the 8,900 freight cars and 98 locomotives for which orders were placed during the year, make this the best year since 1920 and 1922, respectively.

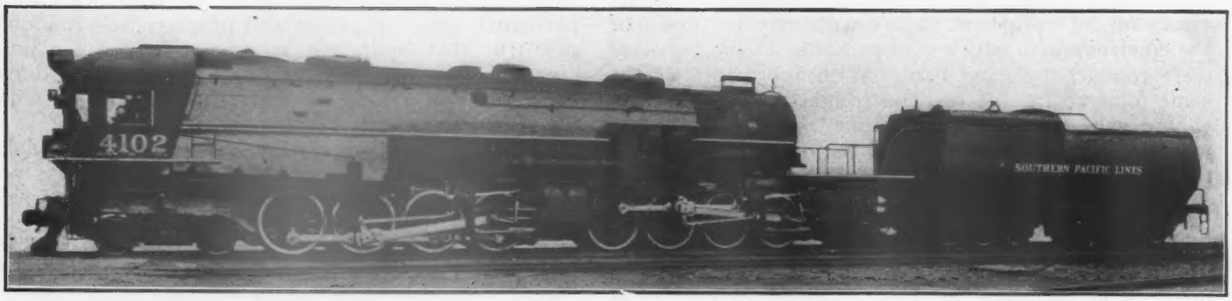
Orders for 1,930 and 334 passenger cars for service in the United States and Canada, respectively, were placed during 1928. In the United States this is the largest number of cars for which orders have been placed since 1925 and, in Canada, the largest number since 1919.

Present Equipment Conditions

There are evidences that the tendencies which have predominated in the locomotive and freight car market in the United States since 1923 have about run their course and that the turning point is now, or soon will be, at hand. In the case of locomotives, installations have been higher than orders continuously since 1923. During the first two years of this period a relatively large proportion of the locomotives installed were also retired from the books of the carriers. After being rebuilt, in the main with certain modernizing betterments, they were reinstalled in the books of the carriers. Since 1925, however, many more locomotives have been retired than have been installed, indicating that a large proportion of the locomotives retired were not considered suitable for rebuilding and that they have been scrapped.

The number of locomotives installed during the first 10 months of last year was 11,090, which is the smallest since 1922. The number of locomotives retired during the same period, however, was 2,600, which is only slightly less than the average number retired during the years 1911 to 1916. This indicates a continuation of the cleaning-up process, with a resulting decrease both in the number of locomotives in service and in their aggregate tractive force. These trends all indicate that further obsolescence will have to be supplied by new locomotives rather than by old locomotives rebuilt and modernized.

Somewhat the same conditions apply with respect to freight cars. The number of cars installed during the first 10 months of 1928 is less than the number of cars ordered during the year, indicating that here the dependence on rebuilt equipment has at the present time practically ceased. The railroads are continuing to retire more freight cars than are being installed. About 70,000 were retired during the 10 months for which the data was available, as compared with 47,400 installed. When it is recalled that during 1923 approximately 214,000 freight cars were retired while 232,000 were installed and that the number of cars installed has been declining steadily each year since, having dropped below the number retired in 1925 and now having dropped below the number of cars ordered, the evidence of the completion of the general rebuilding program introduced in 1923 would seem to be complete. As in the case of locomotives, the future need for restored serviceability will have to be supplied in a large measure with equipment built new from the ground up.



The fireman's side of the Southern Pacific single-expansion articulated locomotives

Simple Articulated Locomotive for the Southern Pacific

Ten 4-8-8-2 type which develop 112,760 lb. tractive force at 70 per cent. cut-off built by Baldwin

THE Southern Pacific has recently received from the Baldwin Locomotive Works ten single-expansion articulated locomotives with a 4-8-8-2 wheel arrangement. The general specifications were prepared under the supervision of Geo. McCormick, general superintendent of motive power, and the details were worked out jointly by the railroad company and the builders.

These locomotives are designed for use in both freight and passenger service over the heavy mountain grades of the Sacramento Division between Roseville, Calif., and Sparks, Nev., a distanct of 139 miles. On this line, maximum grades of 2.6 per cent occur going East and 2.3 per cent going West. Advantage has been taken of the fact that these locomotives are oil burners, to operate the cab end forward with the tender coupled to the smokebox end of the engine. Although this arrangement has not been utilized on any other railroad in this country, it has previously been employed on a number of Southern Pacific Mallet compound locomotives built at various times since 1909 for use in similar service. Its purpose is to keep the cab clear of smoke and gases when the locomotive is operating through tunnels.

The front end of locomotive referred to in the following description is the end on which the cab is located, or just the opposite from the ordinary locomotive. The right and left sides are designated when looking from the cab towards the smokestack end of the locomotive. The right and left sides are referred to the same as on ordinary locomotives in order that any patterns that are interchangeable with other types of power operating with smokebox ahead will be the same in regard to pattern numbers. "Front unit" designates the engine located adjacent to the cab end of locomotive and "back unit" designates the engine adjacent to the smokebox end of the locomotive.

The new simple articulated locomotives are designed to carry a boiler pressure of 235 lb. and to operate at a maximum cut off of 70 percent. With driving wheels 63½ in. in diameter, they have a tractive force rating of 112,760 lb. The locomotives have a weight on drivers of 475,200 lb. and a total engine weight of 614,600 lb. The combined weight of the engine and tender is 906,900 lb. The wheel base of the combined engine and tender is 106 ft. 5¼ in. A comparison of the principal weights, dimensions and proportions of these locomotives and of several other outstanding single-expansion articulated locomotives is set forth in one of the tables.

The Boiler

The boilers of these locomotives are of large size and capacity. They are equipped with Type E superheaters, having a superheating surface of 2,988 sq. ft. The total evaporative heating surface is 6,505 sq. ft. This gives the large combined total heating surface of 9,493 sq. ft. Despite the large size of the boilers, they are well proportioned, the ratio of combined firebox and combustion chamber heating surface to total evaporative heating surface falling well within the average range of boilers of much smaller size. The firebox has a length of 196⅛ in. and a width of 102¼ in.—a mud ring size which, for a coal-burning locomotive, would provide 139 sq. ft. of grate area. The combustion chamber has a depth of 68 in. from the inside throat sheet and the tubes have a length of 22 ft.

The first course of the boiler is conical in form, with an outside diameter at the front end of 94 1/16 in. The second and third courses, which are cylindrical in form, are 103 13/16 in. and 106 in. in outside diameter, respectively. In general, the construction is along well-established lines. One detail of interest is the application of liners inside the boiler shell where the brackets supporting the feedwater heater and the two cross-compound air compressors are located.

The oil burner enters the draft pan at the back end and is partially supplied with air at this point through a damper-controlled conduit extending backward from the end of the draft pan. Additional air is admitted

through the fire door through a damper-controlled conduit which extends down from the fire door opening through the cab floor. The combined area of the two air openings is proportioned to equal 30 per cent of the gas area through the tubes and flues.

With the tender located behind the smokebox end of the locomotive, the oil supply to the burner must pass through a long conduit. In order to insure a positive flow, air pressure is piped to the oil tank on the tender. The air is supplied from the main reservoir through an air-brake feed valve which can be adjusted to provide pressures varying with the requirements.

The Smokebox Arrangement

The smokebox is built in two sections. The front section is, structurally, a part of the boiler and is built of relatively heavy plate. The waste bearer which supports the boiler on the rear engine unit is located under this section. The back section is of the usual light construction and is flattened at the bottom to provide clearance for the admission of the exhaust pipes from the rear unit cylinders and for curving.

Each unit exhausts through a separate nozzle and stack, the two nozzles and stacks being arranged one behind the other. Each stack is 18 in. in diameter at the choke. The exhaust pipes from the forward unit are carried back along both sides of the boiler and enter the smokebox near the bottom, leading into the front exhaust nozzle. The exhaust steam from the rear unit is carried forward from the cylinder castings through a double ball and slip joint pipe to the bottom of the smokebox where it leads into the base of the rear exhaust nozzle.

Exhaust steam entering the rear exhaust stand passes into an expansion chamber from which steam is taken off for the feedwater heater. The remainder passes out of the expansion chamber through the exhaust nozzle. Additional exhaust steam for the feedwater heater passes directly from the valve chamber of the front unit into a cross-over pipe in front of the cylinders, from which a connection leads up to the Worthington feedwater heater on the right side of the boiler. The steam from the rear exhaust pipe passes through a Y-fitting to two 4½-in. pipes which extend forward to connections on the cross-over pipe, into which the steam passes, and thence to the heater.

The top of the exhaust nozzles of these locomotives is unusually high for oil-burning locomotives, the bottom of the stack extending but 4 in. below the center line of the boiler. To overcome the tendency for the tube-cleaning sand to accumulate in the bottom of the smokebox because of the high exhaust tips, the exhaust nozzles have been surrounded by a sheet metal petticoat pipe, the bottom of which is carried down close to the floor of the smokebox. This serves as a sand ejector to keep the smokebox clear.

The Frames

The frames and crossties are separate steel castings of open-hearth steel, annealed. The top rails of the rear unit have been increased in depth ⅜ in. over the so-called Master Mechanic's standard which is ad-

Comparative Dimensions, Weights and Proportions of Heavy Single-Expansion Articulated Locomotives

Road	Sou. Pac.	C. & O.	Grt. Nor.	D. & R. G. W.
Type	4-8-8-2	2-8-8-2	2-8-8-2	2-8-8-2
Weight on drivers	475,200 lb.	491,000 lb.	532,800 lb.	559,500 lb.
Total weight of engine	614,600 lb.	565,000 lb.	594,940 lb.	649,000 lb.
Cylinders, diameter and stroke	24" x 32"	23" x 32"	28" x 32"	26" x 32"
Driving wheel diameter	63½"	57"	63"	63"
Boiler pressure	235 lb.	205 lb.	210 lb.	240 lb.
Heating surface:				
Evaporating	6,505 sq. ft.	6,443 sq. ft.	7,142 sq. ft.	7,265 sq. ft.
Superheating	2,988 sq. ft.	1,885 sq. ft.	1,896 sq. ft.	2,295 sq. ft.
Combined	9,493 sq. ft.	8,328 sq. ft.	9,038 sq. ft.	9,560 sq. ft.
Grate area	139 sq. ft.*	113 sq. ft.	108 sq. ft.	136.5 sq. ft.
Tractive force	112,760 lb.	103,500 lb.	127,500 lb.	131,800 lb.
Weight on drivers ÷ total engine weight, per cent	77.3	83.0	89.5	86.4
Weight on drivers ÷ tractive force	4.21	4.74	4.18	4.24
Total weight engine ÷ comb. heat. surface	64.7	67.8	65.8	67.9
Tractive force × dia. drivers ÷ comb. heat. surface	754	759	885	871
Comb. heat. surface ÷ grate area	68.3*	73.6	83.6	70.0
Firebox heat. surface, per cent evap. heat. surface	7.89	7.25	6.05	9.84
Superheat. surface, per cent evap. heat. surface	45.9**	29.3	26.5	31.6

* Oil-burning locomotive. ** Type E superheater.

Table of Dimensions, Weights and Proportions

Railroad	Southern Pacific
Type of locomotive	4-8-8-2
Service	Passenger and Freight
Cylinders, diameter and stroke	(4) 24 in. by 32.
Valve gear, type	Walschaert
Valves, piston type, size	11 in.
Maximum travel	6¾ in.
Steam lap	1¾ in.
Exhaust clearance	Line and line
Lead in full gear	3/16 in.
Cut-off in full gear, per cent	70
Weights in working order:	
On drivers	475,200 lb.
On front truck	87,000 lb.
On trailing truck	52,400 lb.
Total engine	614,600 lb.
Tender	292,300 lb.
Wheel bases:	
Driving	44 ft. 7 in.
Rigid	11 ft. 4 in.
Total engine	66 ft. 11 in.
Total engine and tender	106 ft. 5¼ in.
Wheels, diameter outside tires:	
Driving	63½ in.
Front truck	33 in.
Trailing truck	36 in.
Journals, diameter and length:	
Driving, main	12 in. by 14 in.
Driving, others	11 in. by 14 in.
Front truck	7 in. by 14 in.
Trailing truck	8 in. by 14 in.
Boiler:	
Type	Conical
Steam pressure	235 lb.
Fuel, kind	Oil
Diameter, first ring, inside	92 in.
Firebox, length and width	196⅛ in. by 102¼ in.
Combustion chamber length	68 in.
Tubes, number and diameter	91—2¼ in.
Flues, number and diameter	240—3½ in.
Length over tube sheets	22 ft.
Heating surfaces:	
Firebox and comb. chamber	513 sq. ft.
Tubes and flues	5,992 sq. ft.
Total evaporative	6,505 sq. ft.
Superheating	2,988 sq. ft.
Comb. evaporative and superheating	9,493 sq. ft.
Tender:	
Style	Water bottom
Water capacity	16,152 gal.
Fuel capacity	4,860 gal.
Rated Tractive Force	112,760 lb.
Weight proportion:	
Weight on drivers ÷ total weight engine, per cent	77.3
Weight on drivers ÷ tractive force	4.21
Total weight engine ÷ comb. heat. surface	64.7
Boiler proportions:	
Tractive force ÷ comb. heat. surface	11.9
Tractive force × dia. driver ÷ comb. heat. surface	754.
Firebox heat. surface, per cent of evap. heat. surface	7.89
Superheat. surface, per cent of evap. heat. surface	45.9

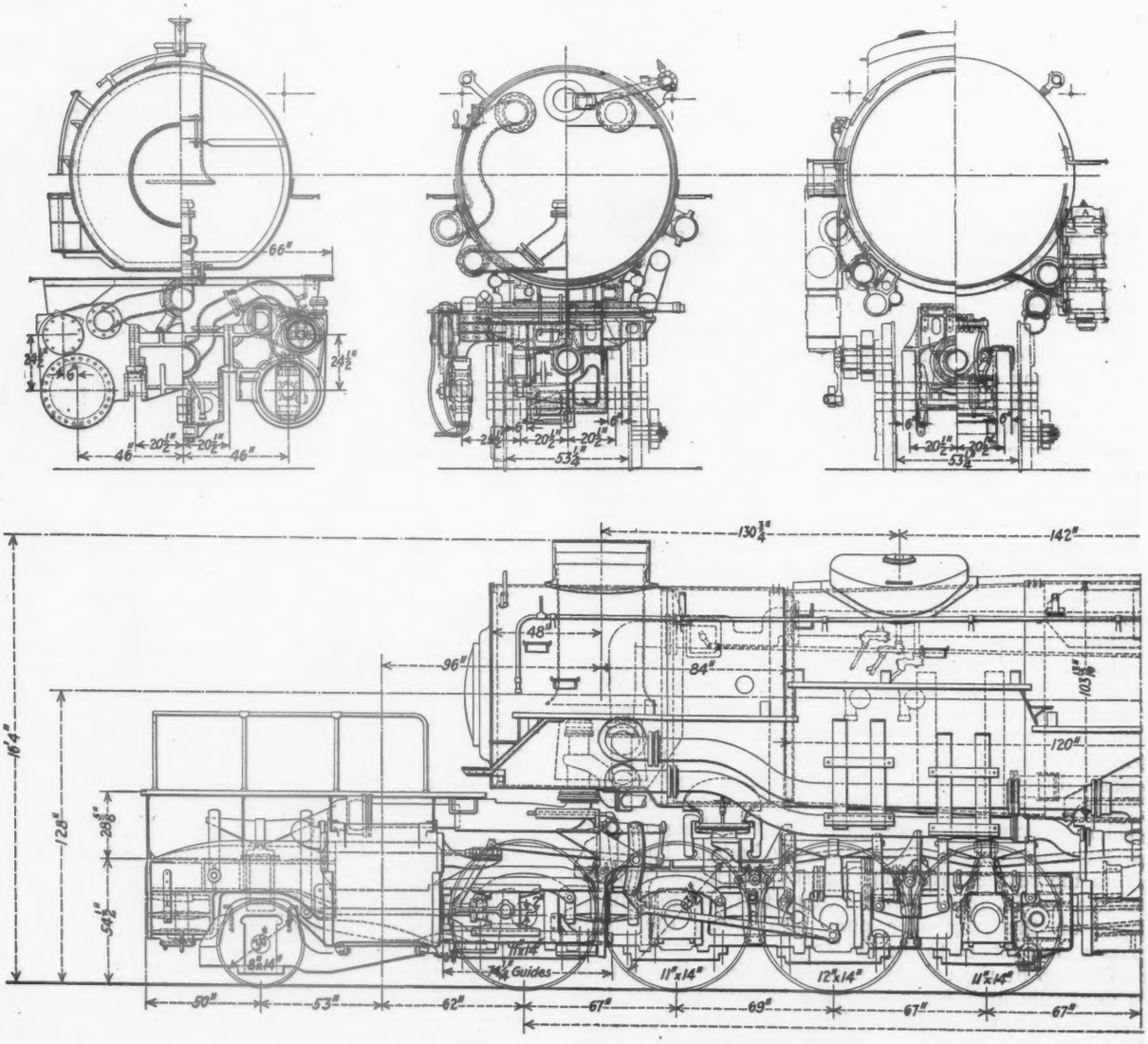
hered to on the front unit, and the bottom rail of the rear unit has been similarly increased in depth by ¼ in. A further addition of 1 in. has been made in the depth of the top rail over the back pedestal of the rear unit, and also over the front and rear pedestals of the front unit. The front pedestals on the front unit and the rear pedestals on the rear unit are provided with double binder lugs.

The rear deck and rear cylinder saddle is formed in a single steel casting. This casting includes the trailing-truck radius-bar fulcrum and extends back to include the rear bumper and tender drawbar pocket. A patent has been applied for by the builders to cover this construction.

The articulation hinge between the front and rear engine units is located 52 in. back of the center line of the rear driver of the front unit and 77 in. forward of the center line of the front drivers of the rear unit. This follows the customary arrangement, but reverses the relative position of the hinge with respect to the cylinders of the unit on which the boiler is mounted, because of the reversal of the direction in which the locomotive normally operates. The articulation pin has a tapered fit at the top and bottom in the saddle casting, these fits being made in renewable bushings. The pin is keyed in from the bottom in accordance with the builder's practice, which is patented.

The firebox is supported on three sets of expansion plates. At the front end (under the cab) the support is arranged in three sections, one between the frames and one outside of the frame on each side. An intermediate support is placed just ahead of the forward pair of driving wheels. Here the expansion plates, which are located under the mud ring at each side, are supported from a heavy rectangular bar extending across the locomotive, which is fitted and securely bolted into the frames. The rear support is located between the frames under the back of the mud ring.

Steam for both engine units is carried forward from the superheater header through two 9-in. pipes. Where these pipes pass over the cylinders of the front unit, 6-in. branch pipes lead to the valve chambers. The two main pipes continue to the front of the cylinders and there are carried down and into the front of the saddle casting. Leading from a passage through the saddle casting, steam is carried backward between the frames in a single 9-in. pipe to the front face of the rear-unit cylinder saddle casting, from which it is carried to the



Elevation and cross-sections of the Southern Pacific single-

valve chambers through outside steam pipe connections. The necessary flexibility in this pipe is provided by two ball joints and two slip joints. The front ball joint is housed within the front saddle casting, but at a point considerably in the rear of the articulation pin. The rear ball-joint housing is securely anchored to a frame cross-tie just forward of the center line of the second pair of rear-unit driving wheels. A second slip joint is placed near the rear cylinder casting to provide for expansion.

The Running Gear and Motion Work

The equalization system is arranged to provide two points of support at the front unit and three points of support at the rear unit. Each side of the front unit is equalized continuously, including one side of the four-wheel leading truck, and there is no cross equalization. The first two pairs of drivers on the rear unit are separately equalized on each side, while the rear two pairs are cross-equalized with the two-wheel trailing truck. Instead of resting directly on the truck bissel pin, the rear end of the trailing-truck equal beam is suspended from the front end of a heavy semi-elliptic spring which is seated on the top of the bissel pin and secured to the deck plate at the rear.

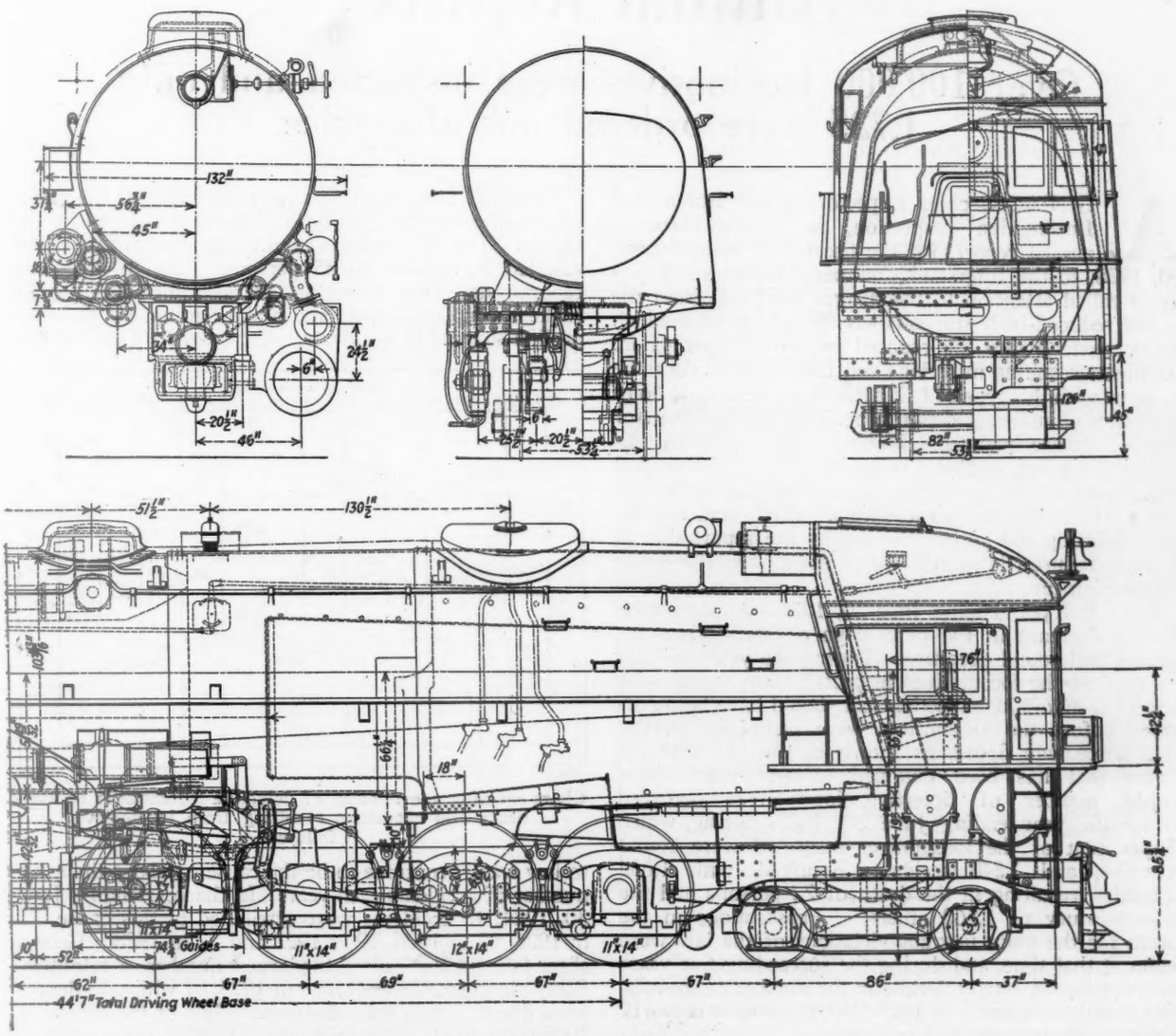
The rear pair of drivers of the front unit and the front pair of drivers of the rear unit are fitted with Alco lateral motion driving boxes. Both trucks are of the Commonwealth constant-resistance type, with outside journal boxes.

Both the driving and truck axles, the wrist pins and piston rods are of carbon steel, quenched and tempered. The connecting rods are normalized and annealed.

The locomotives are equipped with the Walschaert valve motion, having a maximum travel of 6¾ in. and with 1¾ in. steam lap to reduce the maximum cut-off to 70 per cent. The valves are controlled by an Alco reverse gear with a 12-in. cylinder. A single Ashcroft duplex cut-off gage is located in the cab. The piping to this gage, however, is arranged with suitable cut-out cocks so that it may be cut out from the cylinders of one unit and cut in to the cylinders of the other unit.

Lubrication

The cylinders are lubricated by one Nathan Type DV3 force-feed lubricator for each unit. The lubricators are attached to brackets cast integral with the guide yokes and are operated by connections attached directly to the links, which provides a constant pump stroke irrespective of the cut-off. Four of the six feeds



expansion articulated locomotive which operates with the cab forward

of each lubricator supply the steam chests and the cylinders. The other two feeds lead to the two bottom guide bars. Each of these feeds is fitted with a simple terminal ball check under the guide to prevent the return of oil, dirt or water under any conditions. A hydrostatic lubricator is mounted in the cab to lubricate the air pumps and feedwater heater.

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Superheated steam is provided for the feedwater heater, air compressors, the headlight generator, the oil-burner manifold, blower and whistle. The pipe connections betwen the units are completely fitted with Barco joints. Another detail of interest is the location of all sand pipes and the sand traps under the boiler jacket. The locomotives are equipped with two cross-compound air compressors. The main reservoirs are located under the front end of the cab floor.

Water is piped from boiler feed line for cooling purposes to engine- and trailing-truck journals and to driving tires. It is the practice in mountain territory to use tire coolers when descending heavy grades.

Flange lubricators are applied to the front pair of wheels of the engine truck, to the front of the first pair of drivers, to the front of fifth pair of drivers, and to the front of the trailing-truck wheels.

The tenders, which are of the cylindrical type with Commonwealth water bottom frames built integral with the tank, have Commonwealth six-wheel tender trucks. The water capacity is 16,152 gallons and the oil capacity, 4,860 gallons.

The principal dimensions, weights and proportions are shown in the table.

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The fiscal year ending June 30, 1928, showed a substantial decrease in the percentage of locomotives inspected and found defective. During the year, only 24 per cent of the locomotives inspected were found with defects or errors in inspection that should have been corrected before the locomotives were placed in service. This percentage figure, as shown in the chart, is the lowest that has been obtained in any year. The largest number of defective locomotives occurred during the year ending June 30, 1923, during which 65 per cent of the locomotives inspected were found defective, and 1,348 accidents occurred, with 1,632 casualties, resulting in the death of 72 persons and the serious injury of 1,560 others. Prosecutions in the courts for the more flagrant violations of the law were begun at that time, and during the succeeding five years there has been a steady decline in the number of locomotives found defective. In 1927-1928 there were only 419 accidents resulting in 493 casualties.

Defective reversing gears were the cause of the greatest number of accidents during the year covered by the report. The 35 accidents reported as due to this cause, resulted in injuries to 35 persons. As in preceding reports, defective reversing gears, squirt hose, grate shakers, couplers, brakes and brake rigging, are the most prolific sources of accidents. Crown-sheet failures, due

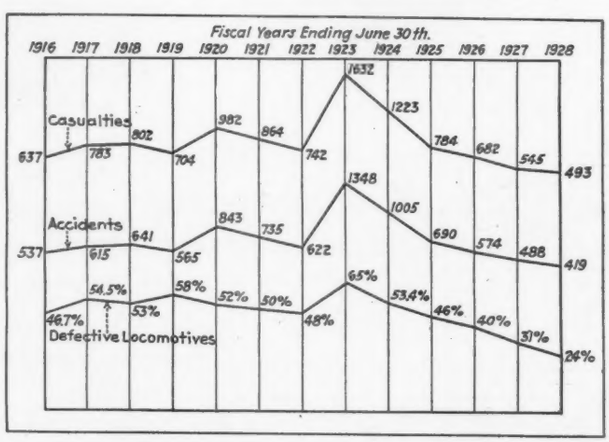

Chart showing the relation of defective locomotives to accidents and casualties resulting from locomotive failures

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persons killed, 17 of whom were killed in this type of accident, and again in the year ending June 30, 1927, 17 deaths out of a total of 28 were on account of crown sheet failures. Thirty persons were killed in 1928, of which 20 deaths were attributed to crown sheet failures. The following is an abstract of Mr. Pack's report.

The Report of the Chief Inspector

A summary of all accidents and casualties to persons occurring in connection with steam locomotives, compared with the previous year shows a decrease of 14.1 per cent in the number of accidents, an increase of 7.1 per cent in the number of persons killed, and a decrease of 10.4 per cent in the number of injured during the year.

Number of Steam Locomotives Reported, Inspected, Found Defective, and Ordered from Service

Parts defective, inoperative or missing, or in violation of rules	Year ended June 30			
	1928	1927	1926	1925
Air compressors	1,282	1,679	2,151	1,574
Arch tubes	103	127	204	198
Ash pans or mechanism	133	192	211	216
Axles	7	13	8	14
Blow-off cocks	469	650	280	825
Boiler checks	914	1,043	1,200	991
Boiler shell	954	1,422	1,888	1,597
Brake equipment	5,214	6,572	7,062	6,497
Cabs or cab windows	1,670	2,055	2,666	2,541
Cab aprons or decks	852	1,086	1,307	1,165
Cab cards	378	575	696	665
Coupling or uncoupling devices	179	289	394	447
Crossheads, guides, pistons, or piston rods	2,088	2,602	3,018	2,922
Crown bolts	164	235	334	283
Cylinders, saddles, or steam chests	3,264	4,526	5,080	4,352
Cylinder cocks or rigging	1,007	1,634	1,904	1,801
Domes or dome caps	281	388	463	371
Draft gear	1,453	2,037	2,634	2,283
Draw gear	1,650	2,210	3,140	3,273
Driving boxes, shoes, wedges, pedestals, or braces	1,990	2,710	3,342	3,241
Fire-box sheets	730	796	1,129	1,152
Flues	464	465	556	524
Frames, tail pieces, or braces, locomotive	1,354	1,682	1,973	2,036
Frames, tender	256	264	373	391
Gauges or gauge fittings, air	461	721	886	694
Gauges or gauge fittings, steam	969	1,425	2,038	1,809
Gauge cocks	1,413	2,024	3,068	3,081
Grate shakers	377	613	720	832
Handholds	1,373	2,285	3,100	2,831
Injectors, inoperative	93	84	78	70
Injectors and connections	5,563	7,188	8,303	8,064
Inspections or tests not made as required	6,623	8,889	10,646	10,436
Lateral motion	699	673	758	659
Lights, cab or classification	118	107	106	86
Lights, headlights	571	835	946	928
Lubricator or shields	500	746	883	704
Mud rings	822	1,073	1,458	1,384
Packing nuts	1,265	1,851	2,772	2,761
Packing, piston rod and valve stem	1,904	2,214	2,489	2,411
Pilot or pilot beams	386	507	638	832
Plugs or studs	619	740	1,087	849
Reversing gear	967	1,247	1,539	1,274
Rods, main or side, crank pins or collars	4,152	5,137	5,683	4,813
Safety valves	172	212	270	234
Sanders	1,031	1,268	1,769	2,004
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Squirt hose	478	644	975	1,008
Staybolts	590	631	905	741
Staybolts, broken	1,867	2,373	3,582	3,745
Steam pipes	1,020	1,308	1,587	1,590
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Tanks or tank valves	1,941	2,747	3,430	3,352
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Train-control equipment	112	....	....	....
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Total number of defects	85,530	112,008	136,973	129,239
Locomotives reported	65,940	67,835	69,173	70,361
Locomotives inspected	100,415	97,227	90,475	72,279
Locomotives defective	24,051	29,995	36,354	32,989
Percentage inspected found defective	24	31	40	46
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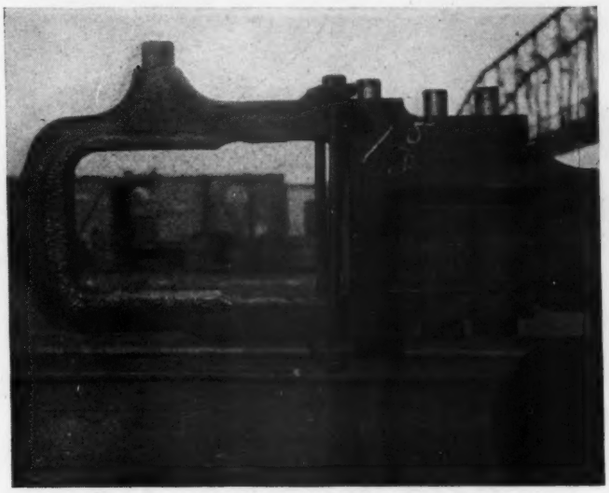

Back end main rod strap to which fusion welding had been applied to reduce the lateral motion of the brasses in the strap

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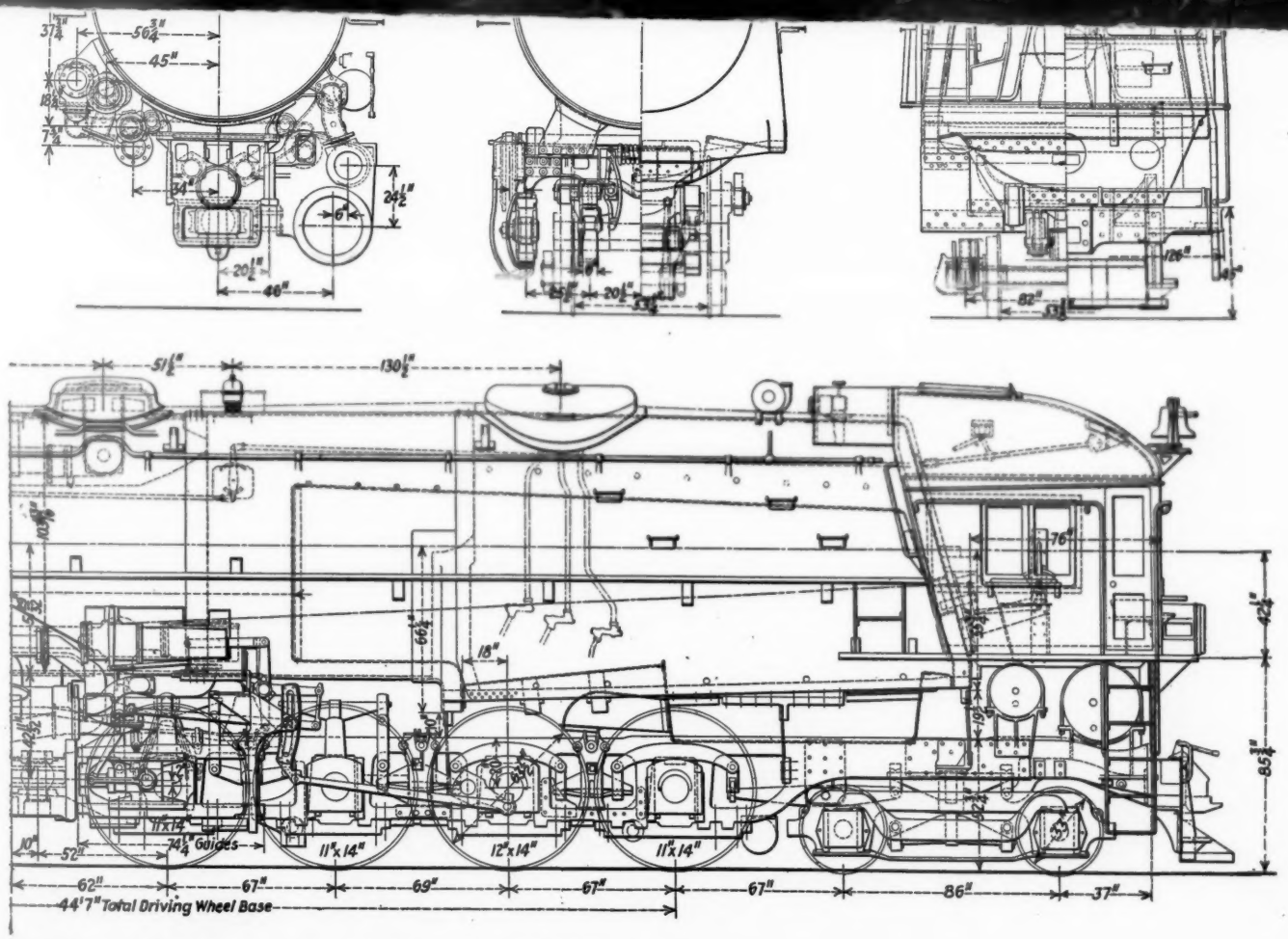
Back end main rod strap which failed due to the application of fusion welding in the manner shown in the preceding illustration



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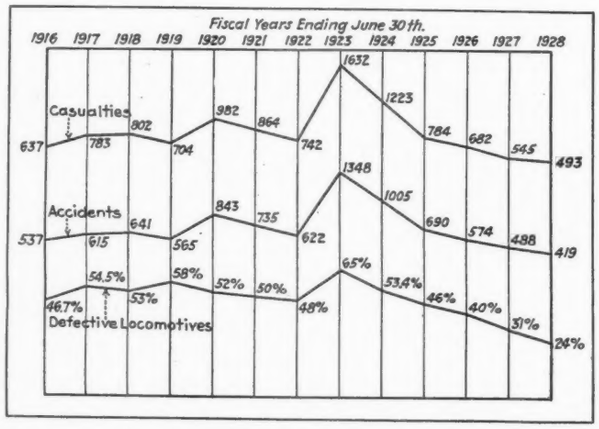

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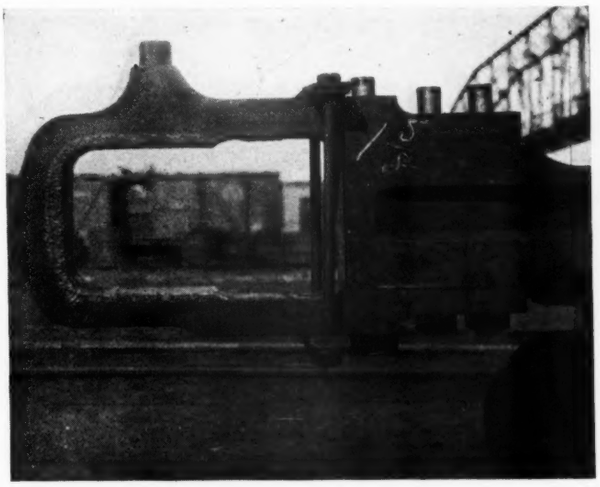

Back end main rod strap to which fusion welding had been applied to reduce the lateral motion of the brasses in the strap

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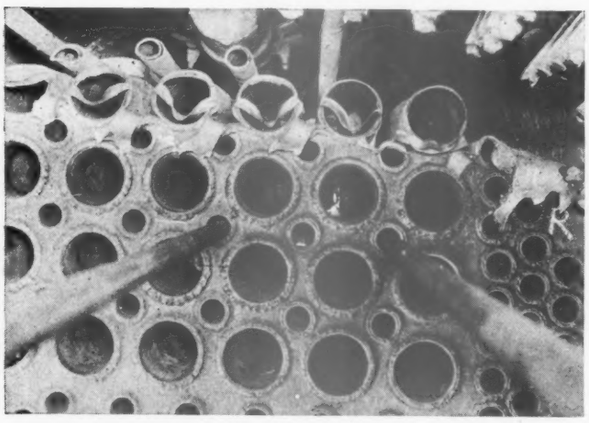
Back end main rod strap which failed due to the application of fusion welding in the manner shown in the preceding illustration

While there has been a substantial improvement in the inspection and maintenance of locomotives and tenders, there are some railroads whose records do not compare



Fire side of flue sheet after an explosion caused by low water—The line of demarcation on the flue sheet was 9 in. below the top of the crown sheet

favorably, and where more exertion may be required in bringing about the purpose and full intent of the federal law.

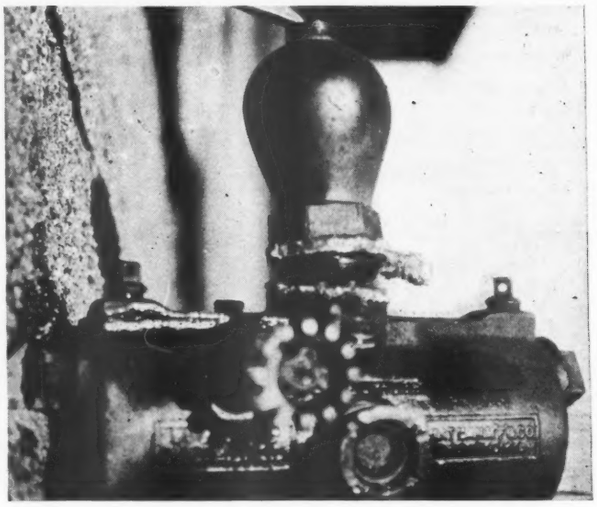
Reduced-Body Staybolts

In my fifteenth and sixteenth annual reports attention was called to the danger resulting from the use of reduced body staybolts having telltale holes which do not extend into the reduced section at least 5/8 in. Accidents resulting in serious and fatal injuries continue to occur with this type of bolt because of the telltale holes not being of sufficient depth to perform the function for which they are intended.

Many of these bolts are improperly applied, the bolts being too long to permit full engagement of the threads on the enlarged ends with the threads in the holes in the sheets. This condition is indicated by persistent leakage after the bolts are installed and attempts to stop the leakage result only in thinning and flattening the heads of the staybolts.

As in former years, boiler explosions caused by crown sheet failures were the most prolific source of fatal accidents. Sixty-six and six-tenths per cent of the fatalities during the year were attributable to this cause. There was an increase of 15.8 per cent in the number of boiler explosions or crown-sheet failures, and an increase of 17.6 per cent in the number of fatalities from this cause as compared with the previous year.

Explosions may be expected to increase in violence with the increasing size of locomotive boilers and the higher pressure carried therein, and accidents of this nature may well be expected to increase as the duties



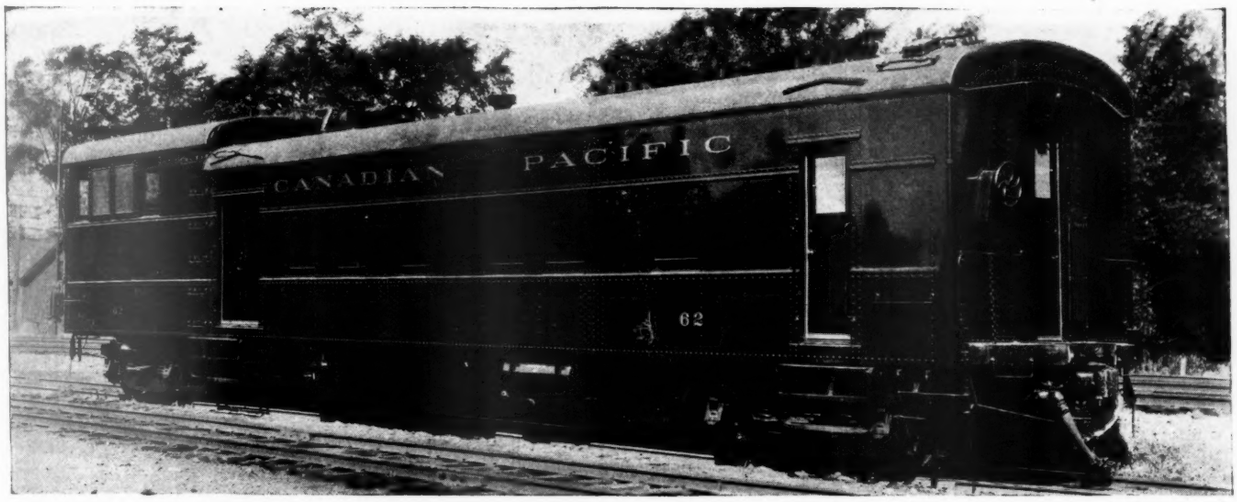
Lubricator in which the threaded connection to the condensing chamber was broken and repairs were attempted by fusion welding of the condensing chamber to the body

and responsibilities of enginemen become more complex and exacting.

Therefore, it is evident that the best thought and efforts of the various agencies concerned with design, construction, maintenance, equipment, and operation must necessarily be exerted, and all practical safeguards provided if this class of accidents is to be reduced and maintained at a minimum.

* * *

Air pumps can be picked up, transported and placed in position on the locomotive with the crane type trucks



The Canadian Pacific dynamometer car

New Dynamometer Car for the Canadian Pacific

Designed for a drawbar pull of 500,000 lb. and a buffing shock of 1,250,000 lb.—A sub-floor is used in the cupola

THE Canadian Pacific has recently placed in service an all-steel dynamometer car built at its Angus shops, Montreal, and designed to withstand a drawbar pull of 500,000 lb. and a buffing shock of 1,250,000 lb. With many years of experience in the operation of dynamometer cars, the Canadian Pacific engineers have designed a car in which many undesirable features that existed in the previous cars have been eliminated and which also provides maximum comfort and convenience for a normal crew of four during and after working hours. The car is 60 ft. long over the end frames and weighs 145,000 lb., fully equipped.

The Underframe

As a car of this type must withstand severe service, it has been provided with an unusually strong underframe. This consists of two 58-ft. 10-in. side sills constructed of 11.6 lb., 3¼-in. by 5-in. by 3¼-in. by $\frac{5}{16}$-in. Z-bars, and fish-belly center sills, 46 ft. 3¼ in. between truck centers. Top and bottom cover plates are applied to the center sill. The structure is rigidly tied together by two crossbearers, numerous cross-ties closely spaced, and adequate diagonal braces. In addition, many steel floor plates are riveted to the side sills and center sills to add stiffness to the underframe.

Two four-wheel Commonwealth trucks with 33-in. steel-tired wheels are used under the car. All of the wheels are fitted with clasp brakes except for the rear wheels of the front truck, on the axle of which is attached the recording paper driving mechanism.

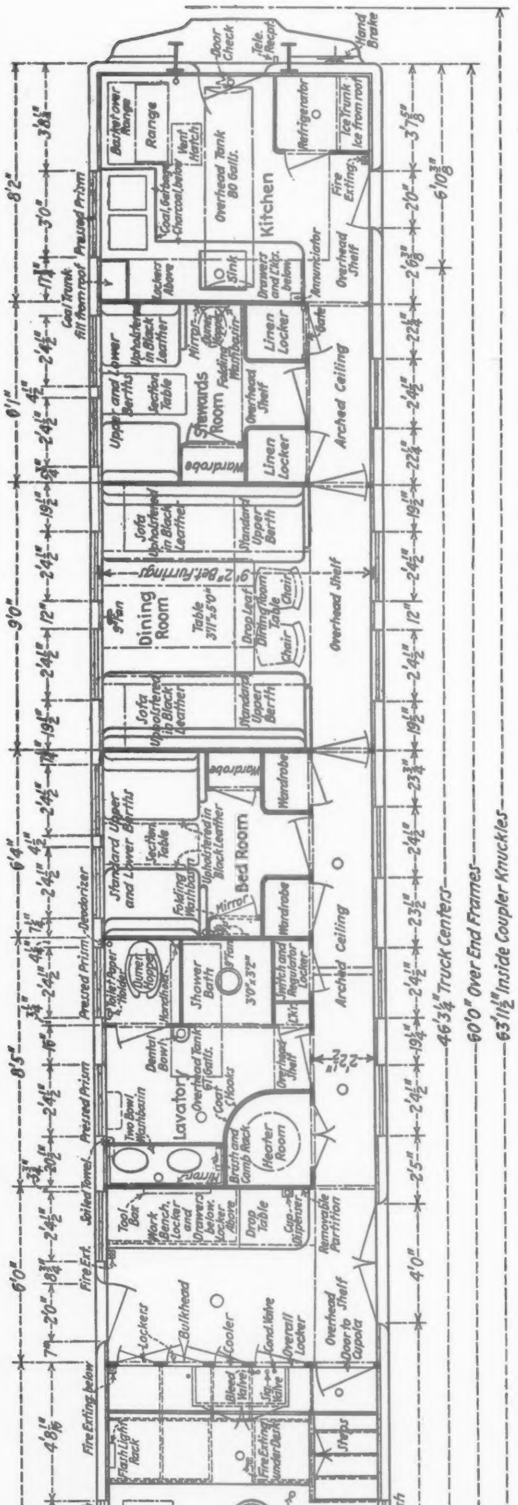
The body of the car is built of steel. As the car will be used in freight service during the winter months, the insulation has been doubled over that used in passenger car construction. Four-ply hair felt is used to line the inside of the car, including the roof. The sides of the car are covered with five-ply mahogany veneer. The veneer was used in preference to tongue and groove construction in order to provide greater warmth in the car and also to provide a smooth surface easy to clean. The surface of the veneer is covered with a filler, varnished and then rubbed to an attractive finish.

The roof is a modified turtleback design, made of wood and canvas covered. Hair-felt lining is used between the roof boards and the headlining, which is painted a cream color and trimmed with a neat stencil border.

Standard windows are used in the main part of the car. Each side of the cupola or recording room is equipped with two sliding and two hinged windows which can be quickly opened by the members of the car crew. Globe ventilators are located along the center line of the car, three in the cupola and two in each of the other rooms. Hatch ventilators are used in the kitchen.

A Sub-Floor in the Cupola

In studying a number of existing dynamometer cars, the weighing head and the transmission unit were located in the recording room with the chronograph table. It was found that these two large units required considerable floor space and made it necessary for the crew to walk around them. To overcome this undesirable feature, a sub-floor was built in the chronograph room or cupola. The sub-floor is 3 ft. 1 in. above the main car floor and is supported on a steel frame. This floor consists of steel plates on which is laid 1¾-in. flooring, covered with linoleum. The main floor beneath the sub-floor is surfaced with asphalt and the weighing head



Floor plan of the Canadian Pacific dynamometer car

and the transmission unit rests on the steel end casting. The remainder of the main floor is of the standard passenger-car floor construction.

The chronograph table rests on a heavy casting attached to the Commonwealth underframe end casting This casting brings the base of the table on a level with the sub-floor. The weighing head and transmission can be quickly reached either through trap doors located in the sub-floor or through two doors located in the rear cupola partition below the sub-floor level. These doors are entered from the work room, which is located directly back of the cupola and on the main floor level. They are furnished with non-breakable glass to provide natural light in addition to the electric lights located beneath the cupola floor. There is no wood construction of any kind beneath this floor.

The Interior of the Cupola

All of the recording instruments located in the cupola, or recording room, can be either operated or observed by the operator seated at the chronograph table. A door leads into the cupola from the front end of the car. A stub platform with a guard rail around it is built outside of this door. In addition to the guard rail, an electric light is located over the door. On each side of the door are two windows, back of which are located revolving leather upholstered seats. At each window are located three electric push buttons, one to call the steward, one for recording mile-post readings and the other for a track light, one of which is located at each side of the front truck. These lights occupy a fixed position on the truck. In addition a fan switch is located at the window on the left side and a platform light switch at the window on the right side of the front door.

Located over the door is the clock, the weighing head alarm bell, a duplex air gage and two relay blocks. The tank, which contains the glycerine and alcohol mixture for the weighing head is located above the front window at the right side of the car. This tank is filled from the roof. The weighing head can be lifted out through a trap door in the sub-floor by a ½-ton Harrington chain hoist which runs on a monorail attached to the roof frame inside of the car.

There are four windows on each side of the cupola, two that slide and two that swing. All of the windows in the recording room are furnished with curtains.

The chronograph table is located at the rear end of the recording room. An upholstered swivel chair is located back of the table.

In previous cars, ample desk room and drawers in which to place records and papers were not always provided. This deficiency has been overcome by building a desk into the rear partition of the recording room. It has ample drawers above and below the desk for storage. A bleader valve, signal valve and conductor's valve are located in the cupboard directly above the desk. Colored cords run from these valves to a point directly over the operator's seat in front of the table.

It has always been a problem in previous cars to remove the chronograph table from the car when necessary. It is easily accomplished in this car by removing the partition into which the desk and cupboards are built. This partition is so designed that it can be quickly removed without destroying the finish of the car. The partition between the work room and the corridor is also removable so that the chronograph table can be taken out of the 4-ft. 1½-in. wide by 6-ft. 5⅛-in. baggage type side door located opposite the work room door.

A flight of three galvanized iron steps lead from the

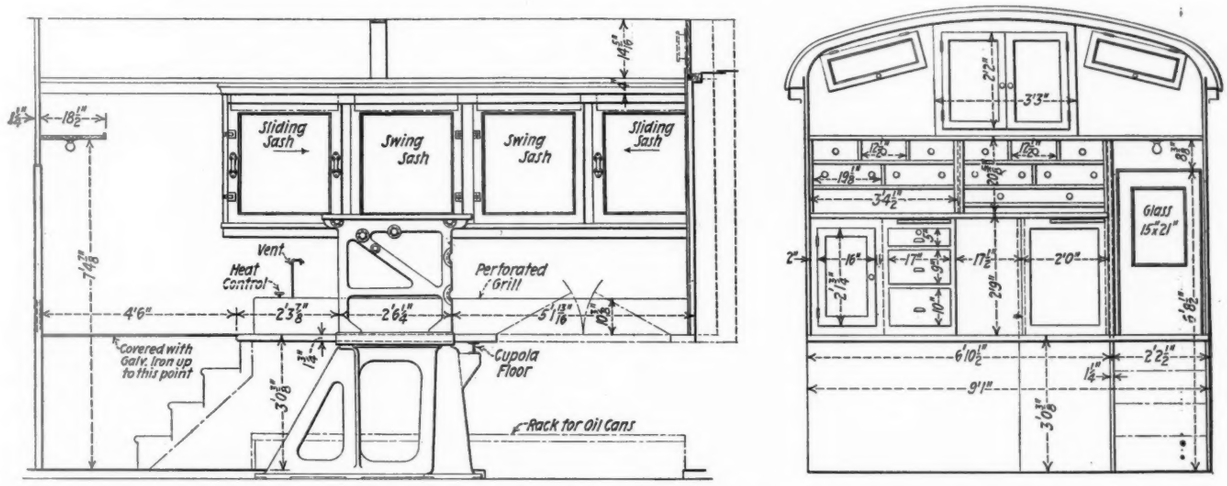
cupola to the main corridor of the car. These steps are covered with lead treads. A door containing a 15-in. by 21-in. glass panel leads from the recording room into the main part of the car. Thus, the recording room can be securely locked from both ends of the car.

Crew Housing Facilities

The work room, lavatory, bedrooms, dining room and kitchen have been laid out and equipped to furnish maximum comfort and convenience to the car crew. Each of the rooms is entered from a common corridor 2 ft. 2½ in. wide, that runs from the recording room to the rear end of the car. The corridor ceiling is of the arched design and paneled with agasote and painted a cream color. Adequate ceiling lights are provided. Three swinging doors are located in the corridor for the purpose of preventing kitchen odors from entering the dining room, bedrooms and the recording room.

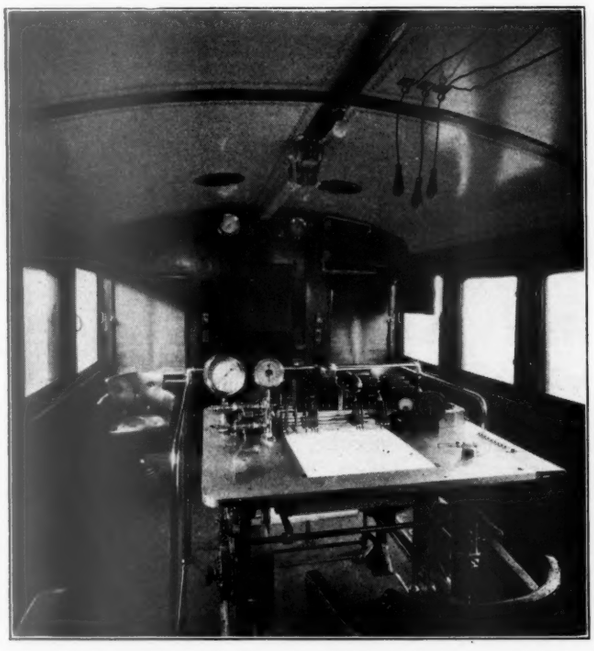
The work room is next to the recording room. It contains a fixed metal-covered work bench 4 ft. 7 in. long by 2 ft. wide. A drop table 2 ft. 7 in. long is located at one end of the work bench. Beneath the work bench are three drawers and a cupboard for tools and car accessories.

Another tool box is located directly above the work bench. Above this is a cupboard 5 ft. 6 in. long and 17 in. deep in which are stored two mattresses that can be used on the work bench and on the desk table top in the recording room in case of an emergency. Above the door leading into the work room is storage space for traveling bags.



Left: A longitudinal section of the cupola showing the sub-floor and the casting on which the chronograph table rests—Right: Arrangement of the operator's desk and cupboard space

Additional lockers are built into the removable partition between the recording room and the work room. A metal-lined, fireproof overall locker and two other smaller cupboards are built into this partition. All of the cupboards, drawers and doors throughout the car are provided with Yale locks.



The chronograph table looking toward the front end of the car

A Shower Bath in the Lavatory

The lavatory, which adjoins the work room, is equipped with all of the conveniences found in the bath room of a modern home. It is 8 ft. 5 in. long by 6 ft. 10 in. wide. The shower bath, which is 3 ft. 2 in. wide by 3 ft. long by 6 ft. 6½ in. high, is provided with hot and cold water. A rubber curtain covers the 2 ft. 3 in. doorway. In addition to the 67-gal. (imperial) capacity tank located above the shower, a 165-gal. tank is located beneath the car floor. A water raising system is used to fill the other tanks in the car from the tank beneath the car floor.

The lavatory also contains two washbowls, a Duner hopper, a dental bowl, two mirrors and other accessories. A vertical row of five small cupboards and a large cupboard is built in the lavatory next to the door. The smaller cupboards are used by the crew in which to keep their toilet articles and the larger cupboard for odds and ends. An overhead shelf 3 ft. wide and 14 in. deep is located over the door and extends over cupboards. This shelf is used for storing spare batteries or luggage.

The Bedrooms

The main bedroom, which adjoins the lavatory, is 6 ft. 6 in. long by 6 ft. 10 in. wide. It contains a stand-

and upper and lower berth. The two facing seats are upholstered in black leather. A section table can be placed between the two seats and a desk lamp placed on it by plugging into a wall outlet. This room is occupied by the man in charge of the car and, by the use of this table, he has available an office closed off from the remainder of the car and in which reports and correspondence can be dealt with.

This room also contains a folding wash basin above

The shower bath and lavatory—Individual shelves for toilet articles are inclosed by the narrow door at the right

which is located a 14 in. by 22 in. mirror, one wardrobe 10½ in. wide by 14 in. deep, and two other wardrobes 23¾ in. wide and 18 5/16 in. deep on each side of the door. The latter are entered from the corridor and are used by the crew for overcoats and other wearing apparel. The floor of this room is carpeted.

The other bedroom, which is next to the kitchen, is used by the steward and is similar to the one described above, except that it contains a Duner hopper, above which is a folding wash basin. The floor is covered with battleship linoleum. It has a wardrobe 15 in. by 24 in., and has an overhead shelf 6 ft. 1 in. long by 2 ft. 2¼ in. wide with a 1 in. metal rail running across the front. It also contains two linen lockers 22⅞ in. wide by 2 ft. 2 in. deep, the doors of which are opened from the corridor.

The Dining Room

The dining room, which is 9 ft. long and 6 ft. 10 in. wide, is located between the two bedrooms. A large sofa, upholstered in black leather, extending the full width of the room, is located on each side of the dining room table. These sofas are used as berths and in addition, a standard upper berth is located above each of them. With the two chairs located at the end of the table, eight people may be served at one sitting. A wood shelf with a metal railing, extends between the two upper berths above the windows at the side of the car. Two ceiling lights are located in the dining room.

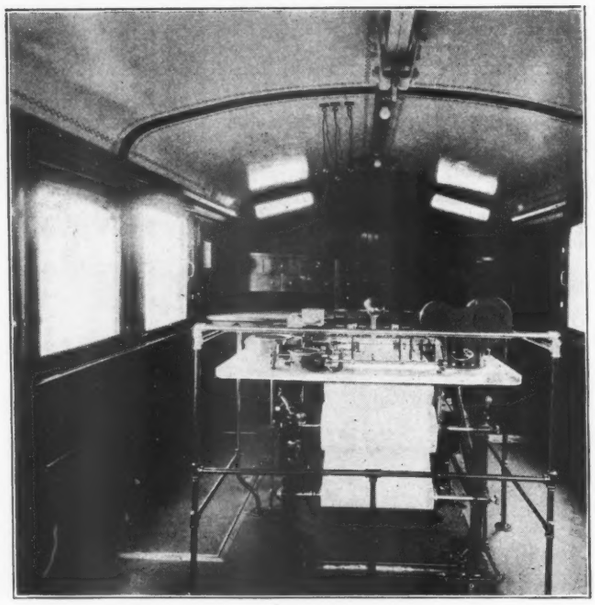
A 3 ft. 11 in. opening, without a door, leads into the dining room from the corridor. A swinging door is located in the corridor at each end of the dining room, thus closing this room off from the remainder of the car.

The Kitchen

The kitchen, which is located at the rear end of the car, is comparable with the kitchen of a private car. It is fitted with a standard official car coal range. This is partially covered with Monel metal and the rear vertical section beneath the warming oven is covered with white tile so that the stove can be easily kept clean. It is provided with a Monel covered sink and ample lockers and drawers. A large refrigerator, which is located in the left corner of the kitchen, is iced from the roof. The coal bunker is also filled from the roof.

How the Car Is Heated and Lighted

The car is heated by a hot water heating system, heat being obtained either by steam from the train line, or by fire in a coal heater in the car. The heater is



A rear view of the chronograph table looking toward the removable partition at the rear of the cupola

located in the passage near the lavatory. In addition to the usual longitudinal heating coils, extra coils, surrounded by fins, are located in each room, and are regulated by radiator valves, independently of the main heating coils in the car.

Owing to the large amount of current required for a car of this type, it has always been found difficult to obtain sufficient battery capacity. To overcome this trouble, the car is equipped with a special low-speed axle generator so that it will cut in when the car is used in slow-freight service. In addition, a locomotive headlight generator set is located on the car roof. It is used to furnish light directly or to charge the batteries, by connecting to the steam line when a locomotive is on a freight train or by connecting to a steam line in the yard when the car is lying in at a terminal.

The Recording Mechanism

The car is furnished with a Burr weighing head, made by the Baldwin Locomotive Works, axle drive, transmission, chronograph table and dynamometer electrical system with modifications and changes based on the experience of the road in the operation of dynamometer cars. The weighing head has a capacity for drawbar pull of 500,000 lb. and a capacity for buffing of 1,250,000 lb. The buffing connection from the weighing head to the chronograph table, however, is not connected and buffing forces will not be recorded.

The jack screws for locking the weighing head lever in a central position are located in the head of the machine instead of in the head yoke, to permit the removal of the yoke without having to remove the pistons. The piston heads are supported by ball bearings. The fulcrum between the drawbar and the weighing head lever is fitted with roller bearings and also an Alemite lubricating attachment.

No changes of importance were made to the standard axle drive and transmission unit. The gears regulating the paper travel are arranged to give travels of $\frac{1}{16}$ in., $\frac{1}{4}$ in. and 1 in. per hundred feet of car travel. The motor drive for the paper roll is arranged to give a paper speed of $3\frac{3}{8}$ in., 16 in. and 60 in. per minute. The distance timer is arranged to make automatic electrical contact for every 100 ft. of train travel.

All transmission levers, motor rheostat controls and switches for the entire apparatus are arranged so that they can be controlled by the operator in the cupola without leaving his seat.

The speedometer drive, timer and paper-drive gear, usually located under the chronograph table, are arranged on the base casting, located under the cupola floor, with shafts extended vertically through the subfloor to the connections of the table mechanism.

The Chronograph Table

The equipment carried on the chronograph table has been arranged so that all of it comes within the confines of the table, thus eliminating any part of the equipment from extending over the edge of the table. As may be seen from one of the illustrations, the portion of the table in front of the operator has been kept as free as possible from operating parts. All of the 16 recording pens are so arranged that a complete record is made on recording paper 18 in. wide. The fluid pressure gage and the Boyer speed recorder are located on the table instead of elsewhere in the car. New style enclosed Veedor revolution counters are mounted on the table.

The 12 pens in the front bridge bar include two six-second pens, a one-minute interval pen, distance-interval pen, a mile-post pen, a speed pen, one integrator pen, a drawbar-pull pen, a brake-pipe pressure pen, a brake-cylinder pressure pen and two extra pens. There are four datum pens back of the front bridge bar. These pens record the brake cylinder pressure, train line pressure, drawbar pull and the speed. All of the recording-instruments can be seen by the operator from his seat in front of the chronograph table.

A metal cover can be locked in place over the table, when it is not in use.

Method of Communication

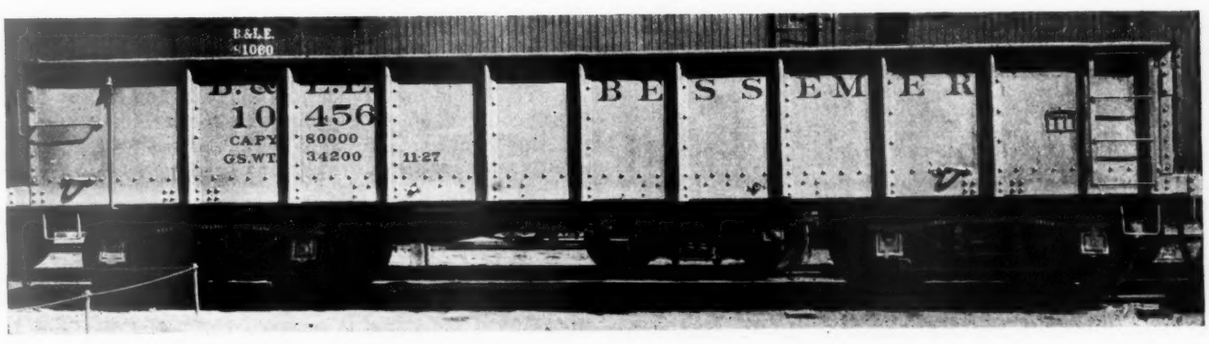
Instead of the usual system of telephonic communication by a code system, this car is equipped with Laryngaphones, developed in England during the World War for use on tanks. The Laryngaphone is a noise-proof telephone and differs from the conventional telephone in that it is operated by the directly-applied mechanical vibrations of the larynx, or vocal cords, instead of by sound waves issuing from the mouth. The Laryngaphone transmitter is held against the side of the throat.

The headset type, which is used on this car, consists of a pair of ordinary receivers on a headband and a transmitter mounted on a strap which holds it in position against the throat, leaving both hands free. When speaking, an ordinary conversational tone is used. The vibrations of the larynx, through the walls of the throat, act on the transmitter and are reproduced as perfect speech in the listener's receiver, free from the interference of all outside noises.

The transmitters and receivers are connected in series in a two-wire circuit, without induction coils or condensers. The required current is obtained from a six-volt battery. This hook-up is used so that all of the observers can be addressed simultaneously. This equipment was secured from the Toronto representative of the Telephone Manufacturing Company, Ltd., of London, and is the first installation of this kind in a railway car on the American continent.

As this system of communication has eliminated the use of the code system of informing the chronograph operator from the cab as to the superheat temperature, boiler pressure, etc., a rubber stamp is used to place this information on the recording paper. The operator stamps the recording paper and fills in the information as the data is given to him over the Laryngaphone by the observer stationed in the locomotive cab.

* * *



First gondola of Schoen design, built in 1899—One of the cars placed in the permanent exhibit of the Bessemer & Lake Erie at its Greenville, Pa., shops

Angle Cock Elimination*

Conditions leading to development of this practice—Summary of advantages and disadvantages

By J. P. Stewart
General Supervisor of Air Brakes, Missouri Pacific, St. Louis, Mo.

DURING the past few years there has been considerable controversy relative to the elimination of angle cocks on passenger cars; tests have been made and in some localities this practice has proved so satisfactory that the handle of the angle cock has been locked in open position so that the angle cock would be there in case the car went to foreign lines but would not be in service when on home territory.

There are two sides to a question of this character and, in this paper, I am attempting to be perfectly neutral, presenting both sides fairly, without criticism or suggestions, showing why it was first thought necessary to eliminate angle cocks and how this was brought about.

The elimination of angle cocks is advocated to prevent the hazard of accident on account of enginemen not being able to apply the brakes should an angle cock become closed.

The original angle cock was not the self-locking type, and had the habit of becoming closed, or partially closed enroute, causing accidents. This brought about the adoption of the present self-locking angle cock. The new angle cock is an improvement. It reduced the number of accidents due to the angle cock closing, but we still occasionally hear of angle cocks becoming closed, accidentally or otherwise.

History of Angle-cock Elimination Tests

The only way to eliminate entirely the possibility of an angle cock becoming closed is to eliminate the angle cock. W. W. White, supervisor of air brakes on the Michigan Central reported that following an accident in 1894, the angle cocks were removed from their passenger locomotive tenders and not restored until 1907. I also understood that the Louisville & Nashville has operated without angle cocks on passenger locomotive tenders for years.

J. W. Walker, chief air brake inspector on the Central Region of the Pennsylvania, recommended the removal of angle cocks from passenger trains years ago, and submitted the subject to the Pittsburgh Air Brake Club for discussion.

Following an accident at Dunkirk, New York in July 1919, a sub-committee, appointed by the Railroad Administration, held a meeting in the Interstate Commerce Commission building at Washington, Friday, September 12, 1919, with representatives present from the New York Central, Atchison, Topeka & Santa Fe, Baltimore & Ohio, Pennsylvania, and the Westinghouse and New York Air Brake companies. The chairman, A. W. Gibbs, made a report of the meeting to the late R. L. O'Donnell, then general manager of the Pennsylvania, suggesting that tests be conducted, and under date of October 27, 1919, Mr. O'Donnell recommended that tests be made on the Pennsylvania at Harrisburg, Pa., which tests were conducted November 6 and 7, 1919, with and without the use of angle cocks. The results of these tests were satisfactory to the committee, which reported that the only delays which occurred to trains were caused by men not fully understanding the operation desired.

A rear-end collision between trains 219 and 185, which occurred at Manhattan Transfer on the Pennsylvania, February 24, 1925, caused by a closed angle cock, convinced the management of that road that something should be done to prevent a recurrence, so under date of June 3, 1925, J. T. Wallis, then chief of motive power of the Pennsylvania System, issued instructions to conduct tests at their principal terminals, which tests were conducted during the months of June and July, 1925. The results were entirely satisfactory to the Pennsylvania and proved to that road the feasibility of operating without the use of angle cocks.

Sometime later the question of operating trains without the use of angle cocks was submitted to the American Railway Association and a sub-committee was appointed and tests were conducted on several railroads, including the Pennsylvania at Harrisburg, Penna. I am informed that these tests were satisfactory.

Early in July, 1926, the Pennsylvania decided that beginning 12:01 a.m. October 1, 1926, their passenger trains would operate without the use of angle cocks, the angle cocks being locked on all cars, and locomotive tenders used in passenger service, in open position, using a special lock.

In order that all concerned would be thoroughly informed, practical demonstrations were conducted at their principal terminals, and in the Western Region, operation without the use of angle cocks was started on September 15, two weeks before the effective date.

When trains are not broken up and only the change of a road locomotive is necessary, the instructions require enginemen to make a service brake application of 25 lb., after which the brake valve is placed in emergency position. The air brake hose is then to be parted between the locomotive tender and car, and the air brake hose coupler on the locomotive tender placed in the dummy coupling. A signal is given to the engineman for a release of the brake, and the engine can then be cut off in the usual way.

Prior to the departure of a train, after the road engine is coupled to the train, the engineman is required to make a service brake application of 25 lb., then placing the brake valve in emergency position and leaving it there until the signal is received for a release. The inspector then removes the hose from the dummy coupling on the locomotive tender and unites it with the hose coupler on the first car in the train and signals the en-

* Abstract of a paper presented at the convention of the Master Car Builders' and Supervisors' Association, at St. Louis, Mo., Sept. 11 to 13, 1928.

gineman to release the brake, except in cases where a change is to be made in the make-up of the train by a shifting locomotive from the rear. The engineman in charge of the road locomotive does not release the train brakes until the shifting has been completed. The usual air brake tests are then made after the brake system has been charged to at least 70 lb.

On the arrival of a train that is to be broken up without change of road locomotive, the engineman is required to make a service brake application of 25 lb., then placing the brake valve in emergency position, and leaving it there until all shifting movements have been completed. The engine and tender brakes may be released, if necessary, by the use of the independent brake valve.

Switching Practice

In switching road trains, either setting off or adding cars, all switching of cars is controlled by the air brakes. The air brake hose on the rear of the rear car, (furthermost from the locomotive) is coupled either to the dummy coupling on the car or to the back-up hose. After the shifting engine has been coupled to the train and the hose coupler united, the trainmen are required to open the angle or stop-cock on the shifting locomotive to release the air brakes on the cars in the train.

When setting off or picking up cars in a train that is being shifted, the engineman on the shifting locomotive is required to make a service brake application of 25 lb., after which he places the brake valve in emergency and leaves it there until he receives a signal for a release of the brakes. The trainmen or inspectors separate the air brake hose couplers where separation is to be made in the train, and couple them to the dummy couplings or standard back-up hose before signaling for a release of the brakes.

When shifting trains without the use of angle cocks, it is necessary to deplete the brake pipe pressure before any separation can be made, which is done by making a service application of 25 lb., after which the brake valve is placed in emergency position until a signal is received to release the brakes. Dummy couplings which are standard for all passenger locomotives and cars, or the standard back-up hose and alarm whistle must be used for closing communication between the brake pipe and atmosphere when making train movements.

The speed of trains while shifting is controlled by the air brakes and in no case should shifting or road movements be made unless the brake system is charged to at least 70 lb.

The Pennsylvania found it was necessary to have some signal to tell the engineman to empty the brake pipe, in case a leaky hose gasket or other defect was found, and decided on six short blasts. As you all know, six blasts of the whistle is a very uncertain signal but it is the only one that was not in use and the only signal they could get the Train Rules Committee to pipe, but as a rule, the men give what they call the "washout."

Advantages of Angle Cock Elimination

The following are the claims of those in favor of elimination of the angle cocks:

(A).—There are no angle cocks to open or close.

(B)—It is much easier to uncouple an empty hose than one charged with 110 lb. of air pressure.

(C)—When switching cars, the work can all be done from one side; there is no necessity for crawling under or over to close an angle cock.

(D)—Eliminates the possibility of a closed angle cock, which might result in loss of life and property damage.

On the other hand the use of angle cocks gives an advantage in switching, and the longer the train or the more cars handled the more the time element enters into this. With modern passenger equipment cars having air capacity of approximately 1,200 cu. in. per car, it takes time to discharge this air and put it back, which is necessary when angle cocks are eliminated. Also to exhaust all this air mean fuel consumption as it is necessary for the air compressor to use fuel in replacing the air that has been exhausted.

The operation of the locomotive compressor, in addition to burning fuel, also increases cost of maintenance.

With modern equipment such as the U. C. valve, emergency is available at all times. The constant throwing of these valves to emergency by exhausting the air pressure will greatly increase the cost of maintenance of the air equipment on cars.

There is also a hazard of accident in uncoupling air hose without the service of angle cocks for everyone with experience knows the kick in uncoupling air hose with pressure in the hose and, where the inspector depends on the engineman to exhaust the pressure before uncoupling the hose, personal injury may result if an inspector thinks the air has been exhausted and it has not.

In conclusion I would like to say that this is a matter to be decided by each railroad and I would like to make three recommendations:

(1) That some terminal on each road be selected and a thorough test be made of switching, with and without angle cocks.

(2) After this test is made and results checked, a competent authority familiar with conditions should decide whether the elimination of angle cocks would be feasible and desirable on that railroad.

(3) That this convention appoint a committee to make a thorough test at some point decided upon by this committee on the switching of passenger cars with and without angle cocks and also visit points where switching is now being done without the use of angle cocks and report their findings and recommendations at the next meeting of this association.

Discussion

A. Berg, (N. Y. C.), said that added fuel consumption, as a result of eliminating angle cocks, is not shown, but should there be added expense it will be more than offset by the increased safety factor. One member stated that switch-engine main-reservoir volume and air-compressor capacity must be increased, otherwise objectionable terminal delays will result. A member from the Pennsylvania testified that two years' experience without the use of angle cocks has shown no serious difficulties or additional work, except for instructing engine crews and train men.

This committee suggested by Mr. Stewart, was appointed and consists of J. P. Stewart, general supervisor of air brakes, Missouri Pacific Lines, St. Louis, Mo., chairman; James J. Bannon, general car foreman, Canadian Pacific; J. P. Egan, superintendent car department, New York, New Haven & Hartford, New Haven, Conn.; E. N. Harding, general car inspector, Illinois Central, Chicago; and James Mehan, assistant to superintendent, car department, Chicago, Milwaukee, St. Paul & Pacific, Milwaukee, Wis.

Hearing on 13-Month Year—Testimony in support of the proposal for an international conference to consider a simplification of the calendar was given at a hearing before the House committee on foreign relations on December 20 by C. R. Dugan, assistant to vice-president of the New York Central, who described some of the difficulties in handling statistics when some months have four Saturdays and others five. The benefits of a uniform basis, he said, would be reflected in many practical ways.

Car Department

Passenger Cars for the C. & N. W.

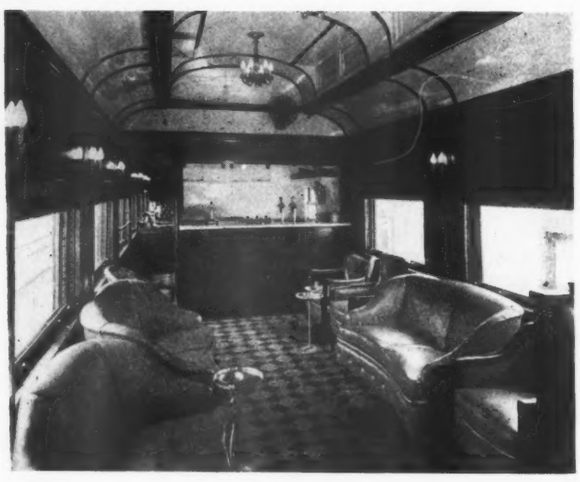
Two North Western trains newly equipped—Total of 51 additional modern roller-bearing cars acquired

ON August 20, the Chicago & North Western placed in service in its North Western Limited (operating between Chicago and St. Paul-Minneapolis, Minn.) and in its newly-christened Corn King Limited (operating between Chicago and Omaha-Sioux City, Nebr.), a total of 51 all-steel passenger cars, equipped with Melcher-Hyatt roller-bearings and containing such recent innovations in passenger-carrying equipment as one-bed bedrooms, glass-enclosed observation parlor and solarium, soda water fountain and luncheonette, Frigidaire ice cube machine, revolving coach seats, electric cigar lighters, etc. This additional equipment includes 34 new sleeping cars, built by the Pullman Car & Manufacturing Corporation, and 17 Chicago & North Western cars, completely rebuilt at the Chicago shops of that company. The latter equipment consists of four lounge cars, four diners, six coaches, two combination coach-smoker-baggage cars, and one observation-lounge-diner.

Coach equipped with revolving type, high back individual seats

Observation Platform Is Enclosed

The rear Pullman in each of the trains contains a solarium, an observation parlor, and six single bedrooms. The windows of the enclosed observation platform are of special glass which admits the ultra-violet rays of the sun. The solarium is equipped with eight reed chairs having leather cushions. An attempt is made



Soda water fountain and luncheonette in club lounge car

to produce a homelike atmosphere in the observation parlor of this car. This is obtained by harmonious variety in the upholstering of the chairs, by the richly-carved wood around the windows and mirrors, by the figured tapestry window shades, the low-placed lights and the parchment shaded lamps. There is also a spacious writing desk with individual lamp and a telephone which is in service up to the time of departure. Further along in this car is a lounge for ladies, attractively decorated.

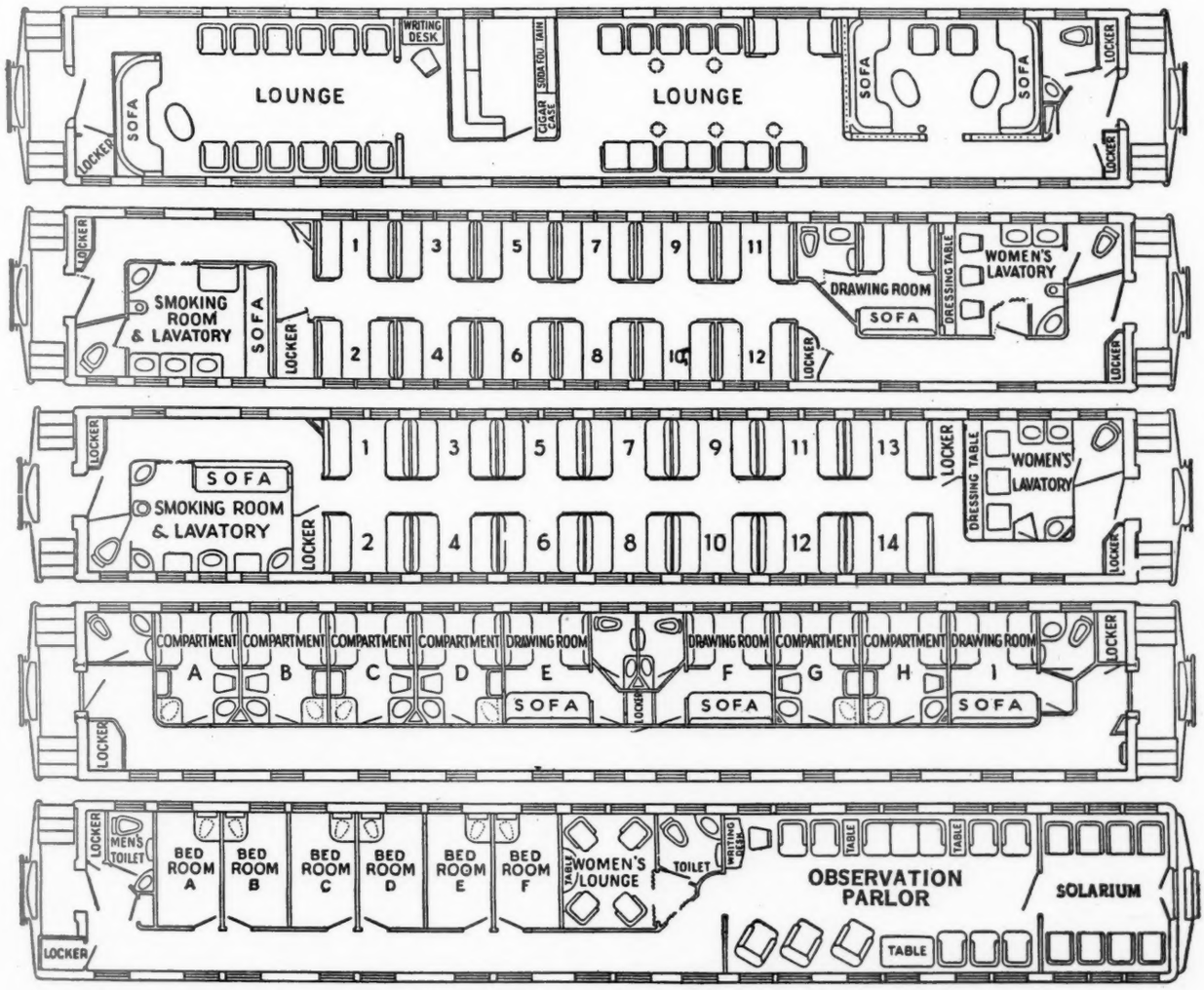
Single Bedrooms Completely Furnished

The six single bedrooms, which open off the corridor, may be used singly or en suite. The full-length beds contain box springs and hair mattresses. In one corner of each room is located a chair, the back of which folds down, revealing a completely-equipped washstand. The chair-seat covers a flush-toilet. There is a cheval-glass in the door and an oval mirror in the wall, illuminated by parchment-shaded lights at the side. A drop-leaf table on the wall can be raised to form a desk. On the wall is a marine clock with illuminated dial. Next to the window is a carafe with ice water. At the foot of the bed is an individual heat control lever. A ventilator is located above the window and another below the mirror on the door. Within easy reach of the bed is a small non-glaring night light; underneath the bed is a servidor for shoes, so placed that the porter can secure them without disturbing the occupant.

The interior of the six-compartment, three-drawing-room Pullman, provided in each train, is decorated with walnut paneling in the corridor and soft tones of tans in the rooms. The upholstering varies in pattern and color in each compartment and drawing-room. The rooms in this car also are so arranged that they may be used singly or en suite. There is a wardrobe in each compartment, added space for clothes in each drawing room and a wall cabinet for toilet articles above the porcelain lavatory. The other fittings throughout the car are similar to those in the bedroom car.

Soda Fountain in Club-lounge Car

The club-lounge car in each train is divided at the center by a soda fountain and luncheonette, provided with toaster and coffee urn. At one end of the car a partition segregates a portion of the room for the use of women passengers. Two plush-upholstered curved sofas and two chairs, also a serving table and suitable smoking stands, are furnished in this section. The balance of the lounge room is upholstered in blue leather. Chairs of different heights, shapes and tilts offer a wide choice of



New C. & N. W. cars (top to bottom): Lounge; twelve-section, one-drawing room Pullman; fourteen-section Pullman; three-drawing room, six-compartment Pullman; solarium, observation parlor, six-bedroom Pullman

seats which may be moved around in groups. Smoking stands, electric cigar lighters, oval card tables and divans are placed where they will be most convenient. "Pull-up chairs" and tables are included in the furnishings. The air is kept clear and fresh by an adequate ventilating system.

In the washrooms of the standard sleepers are porcelain wash-basins. Soap foam in containers replaces the liquid soap. The dressing rooms for ladies have swivel chairs before the dressing tables and porcelain lavatories. American walnut is used as the decoration

Women's room in one end of the lounge car

through the main part of these cars. The permanent walnut head-boards of each section form the basis for a series of arches overhead and make a semi-compartment of each section. In the center of each arch and on each end partition is a parchment-shaded light. The berths are equipped with a new type of cushion mattress in which are incorporated hair padding and coil springs. All windows are equipped with brass sash which is dust

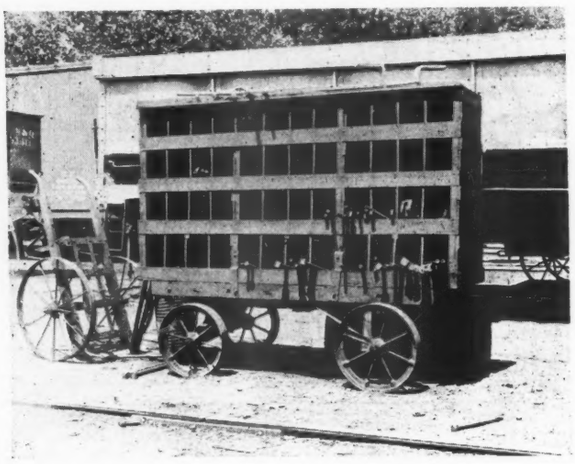
Observation parlor and solarium

proof and which facilitates the movement of the window. Special ventilators are included in all windows.

The new style coaches are said to be the first revolving type seat cars to be used in the West. The high-back seats are of the semi-swivel type and are upholstered in soft plush with double spring cushions. The arm rests, which separate the double seats, may be dropped when desired. An added convenience is the coat rack on the back of each seat. At one end of the car there is a large smoking compartment. Paper towels and soap are provided in the lavatories. All drinking water ice is made on the dining cars by Frigidaire ice cube machines.

Portable Bolt Truck for Isolated Jobs

ON car repair tracks located at a distance from the storeroom, many bolts and washers of various kinds and sizes are required. To eliminate long trips to the storeroom, the bolt truck shown in the illustration was constructed at the Denver shops of the Colorado &



A portable bolt truck for use in the car repair yard

Southern. Forty-eight compartments are located on each side of the truck body, thus providing ample space to hold a sufficient variety of bolts and nuts for the usual run of repair work. The truck is loaded at the storeroom and drawn to the center of activity by a shop mule. The body of the truck is made of lumber and is 8 ft. long and 4 ft. high.

SWING CRANE.—The Loadmaster swing crane, designed to meet the need for a small locomotive type crane of general utility and capable of easily handling loads which cannot be advantageously handled by manual labor, is described and illustrated in the circular issued by Frederic H. Poor, Inc., 50 Church Street, New York. The crane is mounted on a McCormick-Deering industrial tractor.

TRADE STANDARDS.—The Compressed Air Society, New York, has prepared a 48-page pamphlet which embodies the result of extended study and research on the part of the executives and engineers associated with the companies that are members of the society. It embraces the accepted nomenclature and terminology relating to air compressors and their operation, with appropriate definitions; a description of the low pressure nozzle test recommended by the society; instructions for the installation and care of air compressors and recommendations for their lubrication; numerous tables that will be of assistance in the treatment of various compressor problems, and other valuable data. The pamphlet, for which there is a charge of 50 cents, is published in an effort toward the establishment of definite trade standards in the industry.

Pennsylvania Westbound Freight Car Repair Yard

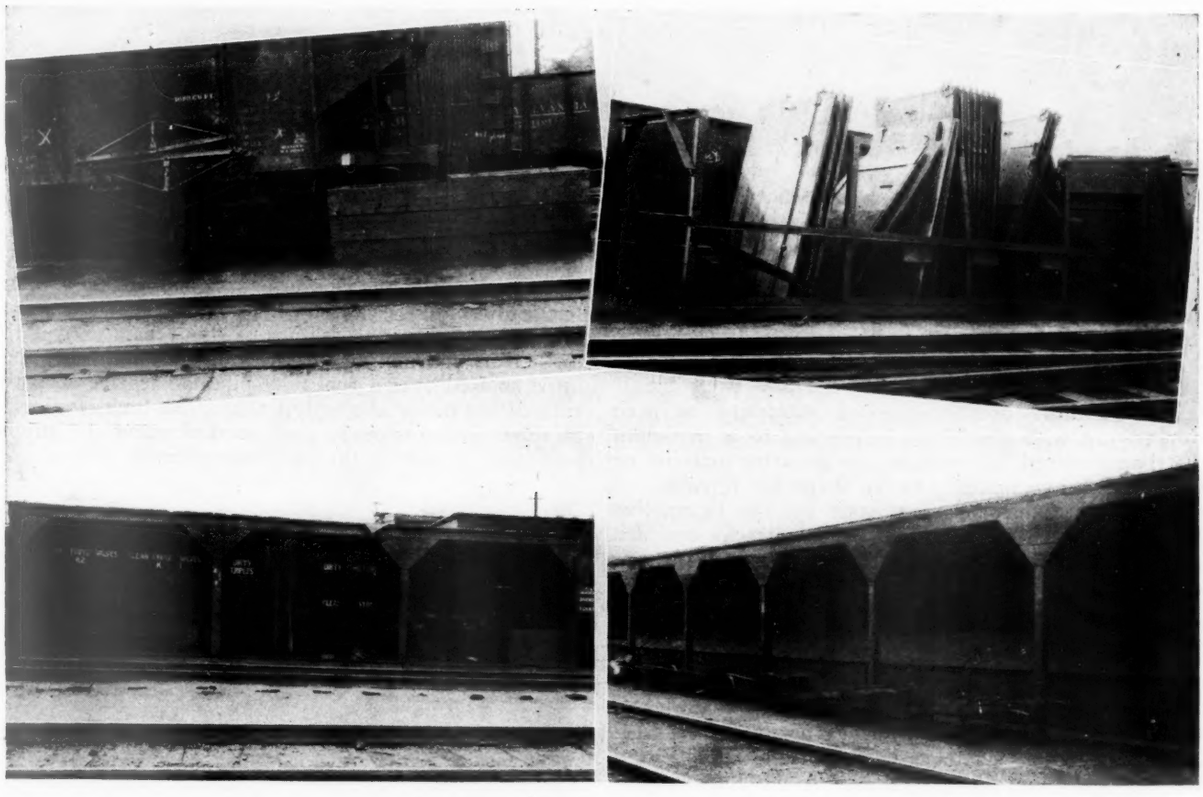
Laid out to reduce shifting to a minimum—Number of cars repaired a month averages 3,752 with a force of 225 men

THE westbound empty car receiving yard is a part of the large classification yards of the Pennsylvania system, located approximately four miles east of Altoona, Pa. Solid trains of empty cars, principally coal cars, are hauled into this yard from the east. Loaded cars are segregated and placed on receiving tracks separate from the empty car receiving yard. The cars entering this yard are chiefly for distribution to shippers located at points between Altoona and Pittsburgh. The westbound hump is located a short distance from the west end of the yard. As it is imperative that all cars be in good order before delivery to the shippers, a car repair track was located near the receiving yard.

In laying out the light repair yard the paramount thing considered was to minimize the shifting. This was accomplished by building the repair yard adjacent to the receiving yard. After cars are inspected and humped, the bad-order cars are pulled back to the repair tracks, and when completed the entire track can be classified over the hump without flat switching.

Referring to the illustration showing the layout of the receiving repair yard, track No. 12 was formerly used for repairing empty cars. As the yard expanded, the capacity of this track proved inadequate to handle the cars requiring repairs. In looking about for a place to build a large repair track, it was decided to locate the repair tracks along the south side of the receiving yard. As the land selected for the repair yard was low, it was necessary to make a fill, 400,000 cu. yd. of the dirt which came from the excavation of the new locomotive erecting shop located at Juniata and previously described in the *Railway Mechanical Engineer*. On this fill were laid seven long tracks, five along the north side of the repair shop building and two along the south side. Two short stub tracks are located at the west end of the main shop building. No. 3 track of the group of five tracks is used by a locomotive crane to serve the two repair tracks on each side. The repair tracks have a capacity for 250 cars.

The first track along the south side of the shop build-



Top, left—Method of storing spare brake beams and a sc rap box for removed journal bearings and airhose; Right—A car-door storage rack made of old angle irons; Lowe r, left—Storage shed for airbrake equipment spare parts; Right—A shed is provided for the workmen's tool boxes

ing is used for loading and unloading supply cars. The second track is used for spray painting the cars. Bad order foreign cars, requiring Class I repairs, are set on the two stub tracks.

The main shop building, which is 762 ft. 11 in. long, by 28 ft. wide, rests on a concrete foundation and is constructed of sheet metal with a fireproof roof. The drawing shows the various repair departments located within this building. Four other smaller buildings of similar construction are located west of the main building. It should be noticed that there are three blacksmith shops located along the repair tracks so as to reduce to a minimum the time required for the workmen to carry repair parts to these shops.

The fuel storage tank which is filled from a tank car which is drained into a pipe located between the rails of the supply track

Facilities for Handling and Storing Material

The handling and storage of material has been worked out with the idea of reducing to a minimum the time required for workmen to go after material or for taking heavy material to the shops for repairs.

Track No. 3 has been set aside for the locomotive crane which can serve the two repair tracks on each side of the running track. All heavy parts, such as wheels, hoppers, doors, trucks, brake beams, etc., are handled by the crane, thus eliminating the necessity of industrial tracks and material trucks. The leader of each gang of repairmen gives the derrick foreman each morning a list of the heavy parts required for the day's work. The derrick delivers this material to the workmen and removes all heavy parts that need repair. Located at strategic points in the repair yard are material bins such as shown in the illustrations. The material is kept under cover and the names of the items contained in each bin are painted on the bin in white letters. The stock sections are kept supplied by the stockman who replenishes them twice each week.

Bins have been provided in which old angle cocks, air hose and journal bearings are placed. Metal drums are located throughout the repair yard to receive the old journal packing. These drums, which are provided with two handles, are picked up by the crane and delivered to a central point where they are unloaded and the waste sent to a central reclamation plant. The old journal bearings are also sent out for rebabbitting.

One of the illustrations shows one of four sheds in which is built a row of tool bins for the workmen. These are located so that the men do not have to go far for their tools and serve to keep the tools out of the lockers in the workroom. The tool bins are locked at night and are protected from the elements.

Handling the Scrap

Every effort is made to keep the repair yard neat and clear of scrap during the day. A laborer, who devotes all of his time to picking up scrap material and placing it in containers located along the tracks, is assigned to each gang of repairmen. The containers are picked up by the derrick and dumped into the scrap car. An additional force of laborers, assigned to the second trick, thoroughly cleans up the yard.

Another interesting feature of this repair yard is the method of distributing the fuel oil. A tank car of fuel oil is spotted over a fuel inlet pipe located between the rails of the material supply track. The tank is allowed to drain into a storage tank located along the supply track, on the side of the yard embankment. On a platform, one end of which rests on the storage tank and the other on the embankment, is built a small shed which contains an air pump for forcing the fuel through the oil supply pipes, which are provided with outlets at convenient locations throughout the repair yard. This system has reduced to a minimum the time and expense required for handling the fuel oil. The pump is

Looking down the locomotive crane track

started in the morning and shut off at night. No time or attention is required when unloading a tank car into the storage tank.

Repairing the Cars

A force of 83 men, including the supervisors, is assigned to three tricks in the receiving yard where the cars are inspected and light running repairs made. The bad-order cars are marked by the inspectors and, as the cars pass over the hump, they are switched to two tracks assigned to receive shop cars. The cars are

One corner of the wood mill

removed from these tracks to the repair tracks during the second trick.

The shop force, including repair men, clerks, laborers, etc., consists of 225 men. The car repair men are divided into six body gangs assigned to repairs. All truck repairs are made by the body gangs. A gang foreman is in charge of each gang. There are also two air brake gangs of nine men each. The distribution of the shop force is shown in Table I.

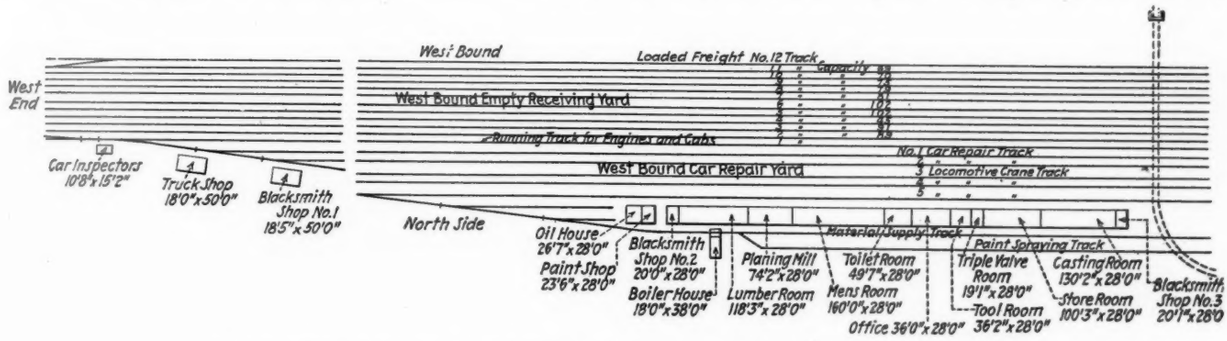
The first thing in the morning the foremen and gang foremen inspect the cars and list the defects on an MP 124 card, one of which is shown in the illustrations. As the repairs are made and other defects discovered, they are written on the card. The repairs are classified as 1, 2, 3, and 4. Reference to Table II shows that approximately 80 per cent of the cars repaired receive Class 4 repairs, or repairs requiring less than 20 man-hours to complete. Very few Class 1 repairs are made, such cars being sent to the main car repair shops. Occasionally a foreign car will be set on the stub tracks for a Class 1 repair.

As the work progresses, the gang foremen constantly inspect the repairs made and check the MP 124 cards to see that the items listed are repaired. The MP 124 card is left with the car until repairs are completed. The gang foreman writes on the card the kind of material required and the price for each item of repairs. The cards are then turned in to the shop foreman's office

The paint track is a considerable distance from the repair tracks

where the piecework charts are made out from the data given on the cards.

At midday, each gang foreman turns in a C.T. 1030 form on which are listed the cars for which he is responsible. The numbers of the cars and what should be done to each when they are shifted during the second trick are listed on this form. This information, together with additional data, is transferred to an MP 242 form, which is a daily report of freight car repairs, copies of which are sent to the master mechanic, the superintendent of motive power, and the general superintendent of motive power. This form gives a complete picture of the kind of cars undergoing repairs, the number of cars left over from the previous day, the number repaired during the past 24 hours,



The location of the tracks and buildings at the westbound freight car repair yard

the number under and awaiting repairs, total bad-order cars, the working force, and information pertaining to shifting, transfer, and the cars held for material.

At the end of the day, the shifting crew clears out all of the tracks. The cars must all be in a condition to move. The gang foremen indicate on each car with chalk whether the car is completed and ready for use, incomplete and should be sent back to the repair yard, or whether the car should be set on the paint track. The cars are then pushed out of the repair yard, over the hump, and reclassified, the cars requiring ad-

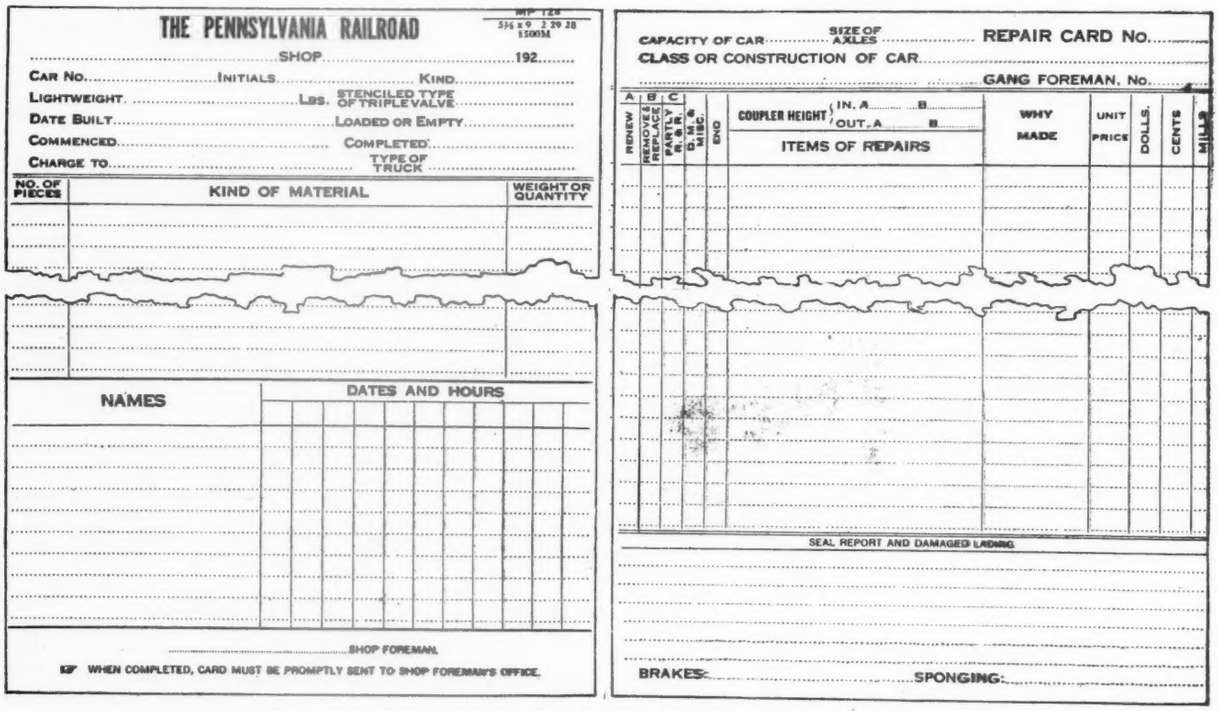
ditional repairs and those ready for painting being switched to the shop storage tracks. After the classification is completed, these cars, together with additional bad-order cars to take the place of the cars released for service, are moved into the repair yard and spotted. As it is impossible to relocate the incompleted cars on the tracks in the same positions they occupied on the previous day without excessive switching, it is necessary for the repair men to find their cars.

This system of classifying the cars in the repair yard over the hump has reduced to a minimum the time required for shifting. Before the repair yard was placed near the hump it was necessary to make many switching movements in order to separate the completed cars from those requiring additional work. As it is now, the cars are pushed over the hump with the regular classification movements and are sorted according to their markings.

Painting the Cars

The cars requiring paint are placed on the long track parallel to the south side of the repair shop. A gang of seven men clean, spray paint and stencil the cars. The cars are first scraped free of dirt and all rust. A workman follows with an air hose which is used to blow off all the loose dirt that has accumulated. The air hose and retaining valve are covered with canvas to protect them from the paint. Two men—one on each side of the string of cars—do the spray painting. The cars are permitted to dry over night and are stenciled the next day.

An examination of Table II shows that for the first eight months of 1928 an average of 292 cars has been



THE PENNSYLVANIA RAILROAD

M.P. 124 5½ x 9 2 29 28 1500M

SHOP ..... 192.....

CAR NO. ..... INITIALS ..... KIND .....

LIGHTWEIGHT ..... LBS. STENCILED TYPE OF TRIPLE VALVE .....

DATE BUILT ..... LOADED OR EMPTY .....

COMMENCED ..... COMPLETED .....

CHARGE TO ..... TYPE OF TRUCK .....

NO. OF PIECES	KIND OF MATERIAL	WEIGHT OR QUANTITY

NAMES	DATES AND HOURS

..... SHOP FOREMAN.

☞ WHEN COMPLETED, CARD MUST BE PROMPTLY SENT TO SHOP FOREMAN'S OFFICE.

CAPACITY OF CAR ..... SIZE OF AXLES ..... REPAIR CARD NO. .....

CLASS OR CONSTRUCTION OF CAR .....

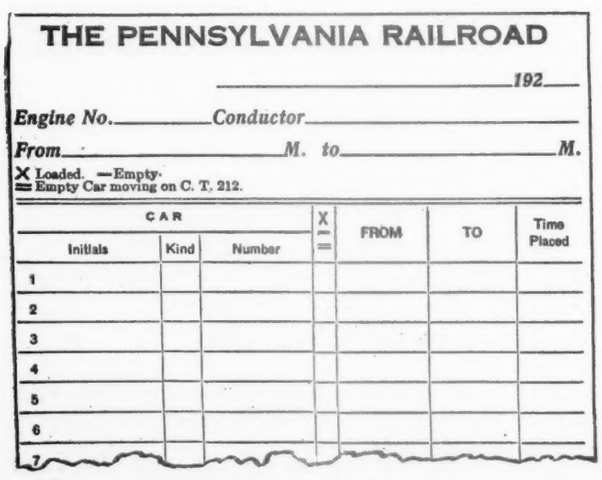
GANG FOREMAN, No. .....

A	B	C						
RENEW	REMOVE & REPLACE	RENEW, REMOVE & REPLACE	PAINT, CLEAN & LETTER	O. M. & MISC.	END	COUPLER HEIGHT IN. A ... B ... OUT. A ... B ...	WHY MADE	UNIT PRICE	DOLLS.	CENTS	MILLS
						ITEMS OF REPAIRS					

SEAL REPORT AND DAMAGED LADING.

BRAKES: ..... SPONGING: .....

Form M. P. 124 is made out by the gang foreman and left with each car



THE PENNSYLVANIA RAILROAD

..... 192....

Engine No. ..... *Conductor* .....

From ..... *M. to* ..... *M.*

X Loaded. —Empty.
= Empty Car moving on C. T. 212.

	CAR			X — =	FROM	TO	Time Placed
	Initials	Kind	Number				
1							
2							
3							
4							
5							
6							
7							

Form C. T. 1030 on which each foreman daily lists the cars under his supervision

Table I—The Employees of the Westbound Car Repair Yard

No. of men	Occupation
1	Foreman
1	Assistant foreman
67	Car repairmen
62	Car repairmen helpers
18	Airbrake men
10	Gang foremen
2	Blacksmiths
2	Blacksmith helpers
1	Planing mill carpenter
20	Laborers
1	Gang leader
3	Machinists
3	Locomotive crane operators
14	Oilers
5	Painters
2	Painter helpers
1	Tool room attendant
1	Stockman
4	Store attendants
3	Clerks
1	Janitor
2	Watchmen
1	Messenger
225	

painted each month. Furthermore, for the first three months of the year, or those months during which the weather is bad, as many cars were painted as during the summer months.

Conclusion

Referring to Table I, it may be seen that a remarkable output is obtained. With an average force of 225 men, as shown in Table I, a monthly average of 3,750 cars was repaired over a period of eight months. For the same period, a monthly average of 1,076 air brakes was cleaned and oiled and 2,639 tested. The average daily output for this period was 124.8 cars.

Special efforts have been made to instill the idea of safety into the minds of the workmen. Safety meetings are held once each month at which time the men are urged to make suggestions as to how to further the cause of safety. The foremen constantly watch the men and instruct them how to do a hazardous job with safety. As a result of their efforts, there has not been a lost-time accident at this repair yard during the past 18 months.

Table II—Performance Record for the First Eight Months of 1928 Obtained at the Pennsylvania Westbound Freight-car Repair Yard, Four Miles East of Altoona, Pa.

Month	No. of cars repaired	By classes				Ave. No. repd. daily	Brakes cleaned and oiled	Brakes tested only	Cars painted
		1	2	3	4				
January	3,562	7	59	215	3.281	114.9	1,146	2,416	248
February	3,334	13	52	211	3.058	114.9	1,095	2,239	295
March	4,083	5	70	280	3.228	131.7	1,065	3,017	319
April	4,106	..	43	286	3,777	136.9	1,113	2,993	288
May	4,255	..	7	434	3.814	137.3	1,086	3,169	296
June	3,992	..	3	344	3,645	133.7	960	3,032	247
July	3,215	..	48	289	2,868	103.7	1,063	2,152	307
August	3,475	..	64	287	3,124	128.7	1,083	2,092	318
Average	3,752	3	43	293	3,412	129.8	1,076	2,639	292

Decisions of the Arbitration Committee

(The Arbitration Committee of the A. R. A. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Joint Evidence Proves Conclusively That Wrong Repairs Had Been Made

On March 18, 1926, the Atlanta, Birmingham & Coast applied one wrought-iron friction bottom side bearing secured by bolts to Michigan Central car No. 98720. On May 13, 1926, a Michigan Central inspector prepared a joint evidence card covering the four wrought-iron friction side bearings in place of four malleable-iron friction bearings secured with rivets. This joint evidence card was presented to the repairing line for its defect card to cover the above-mentioned side bearing, labor only, and eight side-bearing bolts, also covered the handling line repair card. The handling line refused to issue a defect card for the alleged wrong repairs for three reasons: First, when the car was received on the line of the A.B. & C., it was equipped with wrought-iron side bearings secured by bolts and the car was not stenciled showing that malleable side bearings were standard; second, the owner offered no evidence that the car was not equipped on its lines with wrought-iron side bearings, nor did it produce a billing repair card or other evidence to show that the car had been equipped erroneously on any foreign line with these bearings; third, joint evidence was not secured until 34 days after the car was first received home and it was signed only by an inspector of the Michigan Central. The owner contended that the joint evidence card was valid in that it had been procured within 90 days after the first receipt of the car home, as provided in Rule 12. It was pointed out by the owner that it was impracticable to secure a joint inspection at the point where the inspection had been made, because only the Michigan Central maintained an inspection force at that point. The reason given why the car was not stenciled was that when changes were made in standards of construction or maintenance, blue prints covering the changes were prepared and furnished to all repair points where the necessary information is given out to all concerned. Under such a system, it was only reasonable to expect that some inspectors at least, would keep posted on the construction and standards of their own cars and be in a position to know when the cars were not carrying standard parts. For this reason, the inspector knew that malleable side bearings were standard when he found wrought-iron bearings on the car.

The Arbitration Committee in rendering its decision stated that "The joint evidence is sustained. The Atlanta, Birmingham & Coast should issue its defect card for the wrong side bearing, labor only, per Rule 88; as well as bolts applied, in place of rivets,—in other side bearings, as indicated by the joint evidence and billing repair card, as per Rule 87."—*Case No. 1569—Michigan Central vs. Atlanta, Birmingham & Coast.*

Responsibility for Car Destroyed by Fire on Private Siding

Pacific Fruit Express cars No. 21879 and 19762, were received by the Mexican Pacific from the Kansas City, Mexico & Orient on March 2, 1927, and P.F.E. car No. 31011 was received by the Mexican Pacific at the same place from the same railroad on March 4, 1927. At the request of the Mexico-Arizona Trading Company, private shippers of vegetable produce, these cars were placed March 5, 1927, on a private track near its packing plant. At midnight, on March 6, 1927, a fire of unknown origin broke out, consumed the packing plant and totally destroyed P.F.E. cars No. 19762 and 21879 and partially damaged car No. 31011. The partially damaged car was carded for defects and the Mexican Pacific billed for the repairs. Settlement for the totally destroyed cars was requested by the owner, bas-

ing its claim on the fact that at the time the cars were destroyed, they were under the control of two railroad companies and not privately owned cars, inasmuch as the P.F.E. is owned by the Southern Pacific and the Union Pacific. The Mexican Pacific contended, that, as the cars are owned by a private company and were at the time of their destruction and damage actually located on the private spur of a shipper, the case is rather against the shipper, which warrants the withdrawal of the bill for repairs to the damaged car and all claim for the totally destroyed cars. It also contended that Rule 113 did not apply in this case.

The Arbitration Committee in rendering its decision stated that "The cars in question are considered as private line cars in so far as the application of Rules 92 and 113 are concerned; they are also shown as private cars in The Official Railway Equipment Register. In view of Rule 113 the Mexican Pacific is not responsible for the destruction of cars Nos. 19762 and 21879. With reference to car No. 31011, however, the defect card of the Mexican Pacific is full authority for a bill to cover the repairs specified and as such, cannot be repudiated."—*Case No. 1571—Mexican Pacific vs. Pacific Fruit Express.*

Owner Held Responsible Under Rule 120

Car No. 884 of the Kewaunee, Green Bay & Western was damaged to the extent of $900 while moving in a Chicago Great Western train on August 24, 1927. A joint inspection certificate, settling forth the defects on the car and the estimated cost of repairs, was forwarded to the owner on August 30, 1927, with a statement as to the manner in which the car was damaged, as per Rule 44, and disposition requested under the provisions of Rule 120. On September 13, after the owner had received the joint inspection certificate, it sent a representative to inspect the car, who conducted a joint inspection and found that all of the parts were broken new, except one side sill. On September 17, the owner advised the handling line that its findings did not coincide with the information given in the original joint inspection certificate and, therefore, believed that the car was not subject to Rule 120, but to Rule 112 as to responsibility and believed that Rules 44 and 32 were involved. The handling line maintained that the car came under the provisions of Rule 120, Interpretation 3.

In rendering its decision, the Arbitration Committee stated "The car in question was properly reported for disposition under Rule 120. The owner is responsible." —*Case No. 1573—Kewaunee, Green Bay & Western vs. Chicago Great Western.*

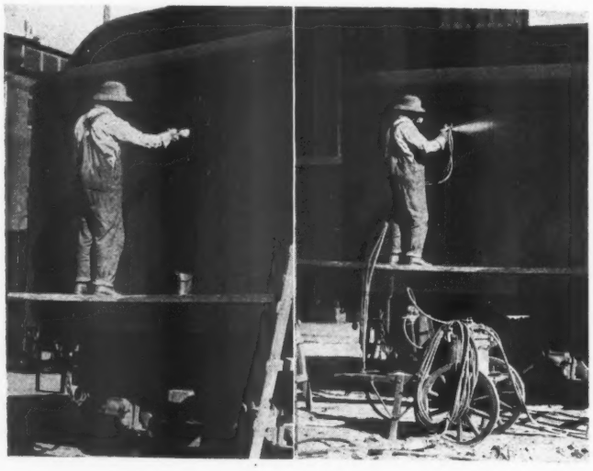
*Time Curtailment in the Paint Shop**

By F. W. Schandelmeier
Paint Inspector, Louisville & Nashville, Louisville, Ky.

TIME-saving devices and methods continue to multiply at a rapid rate. They are not confined to any one trade but embrace them all. They represent patient, untiring effort and expensive development. The fact of clipping off six days from a fifteen-day job, which is an actual accomplishment, representing a gain of 40 per cent, is what is now being done in the painting of coaches in our paint department throughout the system.

The old method of brushing and the new system of spraying both require that the surfaces shall be thoroughly prepared, either by sand blasting, or other effective means, after which the primer should be immediately applied as a first coat operation. The second day the surfacer is applied, then follows the knifing with the usual knifing composition. More surface follows, and then the rubbing process begins with pumice stone and water. Following quickly, but not until the surfaces are entirely ready to receive it, comes the body color, then lettering and striping, and lastly, the varnishing. In this process there are twelve distinct operations, each of which must be followed in systematic sequence in order to obtain satisfactory results.

Under the new lacquer system a car may be finished in three operations with the regular operators and under the same day-work system. The economy which results from the use of lacquer over that of a regular paint and varnish job is shown in the application of the former, as the operations are practically the same up to the seventh day. By using lacquer, a car may be finished in three operations on the eighth day, whereas with paint and varnish, by which we mean the old



Lacquer finishing, shown at the right, reduces the time in the shop by six days as compared with the paint and varnish method, shown at the left

method, six additional days are required to finish the same class car before it is ready for the trimmers.

The painting schedule for the paint and varnish process in the different shops varies to some extent, for which some allowance must be made. Following a general average, we find a car can be placed in service at least six days sooner working under the lacquer system than by the old method. The lacquer we use contains no oxidizing oils, which is an important contributing factor towards its long life. It dries entirely by evaporation of its solvents and not by oxidization as in the case of varnishes and varnish enamels. The lacquer film is a chemically inert body in which no chemical change takes place during its life. The wearing of the film is a process, therefore, of slow erosion.

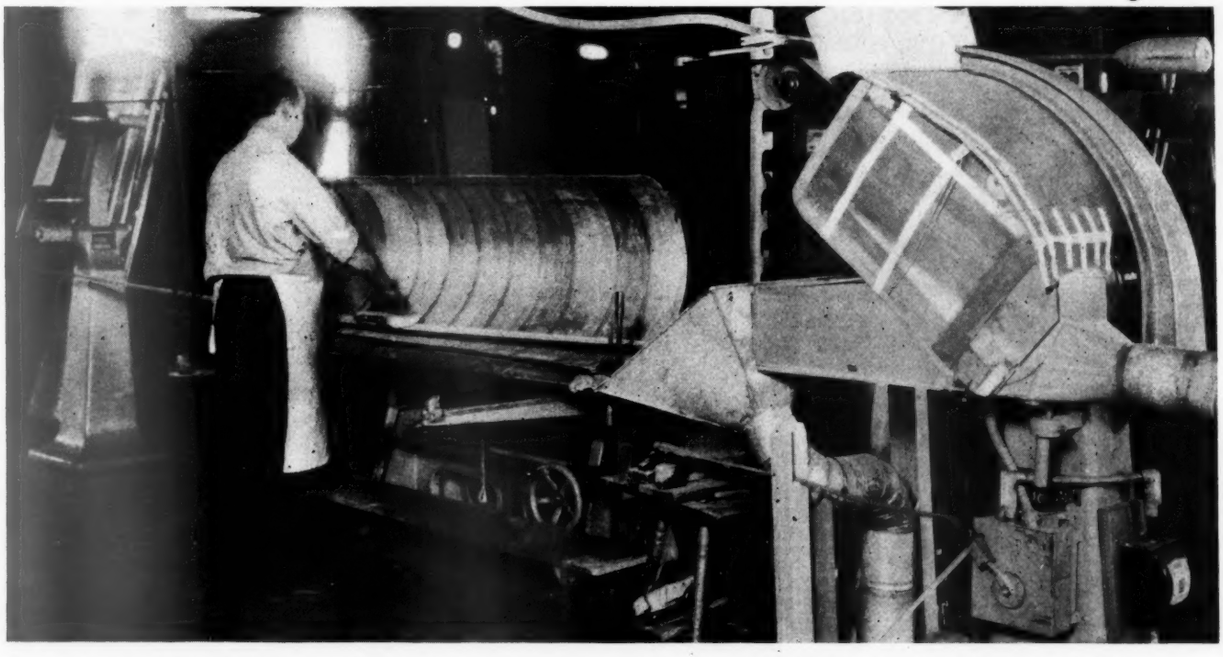
We find that these lacquer jobs stand up very well as compared with brush work. The lacquer dries with a hard surface and is easily cleaned. It does not check nor crack from exposure and it holds its lustre. The system bids fair to become a standard and its popularity extended as we become more familiar with it.

* From the L. & N. Employees Magazine, November, 1928.

New Machines Prove Profitable in Milwaukee Cabinet Shop

Investment in six new tools practically repaid during conversion of 18 sleepers into suburban coaches

EARLY in 1928, a proposition was advanced to convert 18 sleeping cars into modern steel-sheathed suburban coaches at the Milwaukee, Wis., passenger car shops of the Chicago, Milwaukee, St. Paul & Pacific. Inasmuch as this conversion involved the manufacture and application of a large amount of new headlining and panelling, among other things, it was evident that the cabinet shop would be taxed severely to handle this work in addition to its regular routine. A survey of the situation was accordingly made, as a result of which, it was decided to install six new machines including an hydraulic press, a home-made glue spreader, a hand-stroke belt sander, a taping machine, a jointer and a drum sander. These machines, used primarily in making and forming the headlining and ply-wood panelling at a substantial saving in time and labor over former hand methods, were installed at a cost of slightly over $7,500, including purchase price and cost of installation. A study of the savings, made on the 18 cars alone during the period from May 25 to November 10, 1928, indicated a total saving of almost $7,500, so that the savings on other work, a considerable amount of which was handled simultaneously on a number of the machines, represented a net gain.



Hand-stroke belt sander with flexible-back endless abrasive belt used for finishing headlining or molding

Four of the machines mentioned, also a fifth for the efficient cutting of strips from rubber or fabric rolls, are shown in the illustration. Of these machines, possibly the biggest single time- and labor-saver, is the hydraulic press, which replaced a large screw-type press, operated by turning up or down as required a large number of individual screws. With the old press, it was practically impossible to secure a uniform pressure on the forms and, consequently, wavy veneer with blisters and other defects, was the result. Moreover, it took so long to apply and remove the pressure by means of the individual screws, that only a limited number of panels could be put in the press within the time limit governed by the quick setting glue. With the new press, a uniform pre-determined pressure of 75 to 125 tons, as may be necessary, is immediately available and can be released as promptly for the changing of forms or removal of panels. A waterproof casein glue is used at the Milwaukee cabinet shop which requires that the veneer and ply-wood panels be under pressure within 20 min. This allows the application of six headlinings, for example, in the hydraulic press, as compared to one when using the old method.

Mechanical Glue Spreader

The glue spreader consists of double corrugated iron rolls driven by an endless chain in such a way that veneer panels are slowly drawn between the rolls, acquiring a thin uniform coating of glue on both sides and

then being piled one on the other and placed in the proper forms in the hydraulic press. The amount of glue spread on the panels can be regulated accurately to prevent staining fancy wood and, in addition to the labor saving, there is a saving of 50 per cent in glue consumption over former methods of hand application. One important feature of this machine is the arrangement of the glue container, which extends the entire length of the rolls, so that practically all of the glue can be used at the completion of each day's run.

The hand-stroke belt sander illustrated also saves a great many hours of hand labor in securing the desired degree of finish on panels and molding of all sorts, and not only is the work done quicker, but a better job is secured. A cloth, flexible-back belt, with artificial abrasive, has been shown to give the best results. The abrasive belt travels at high speed and is brought in contact with the panel to be smoothed by hand pressure on a block as illustrated. By using special blocks, different kinds of moldings can be sanded. By means of an ingenious clamping arrangement to a special movable table, circular and other odd shaped panels can be readily moved in the machine for most convenient application of the sanding belt. Reference to the illustration will show that special provisions has been made to take care of all dust by means of suitable hoods and galvanized iron suction pipes.

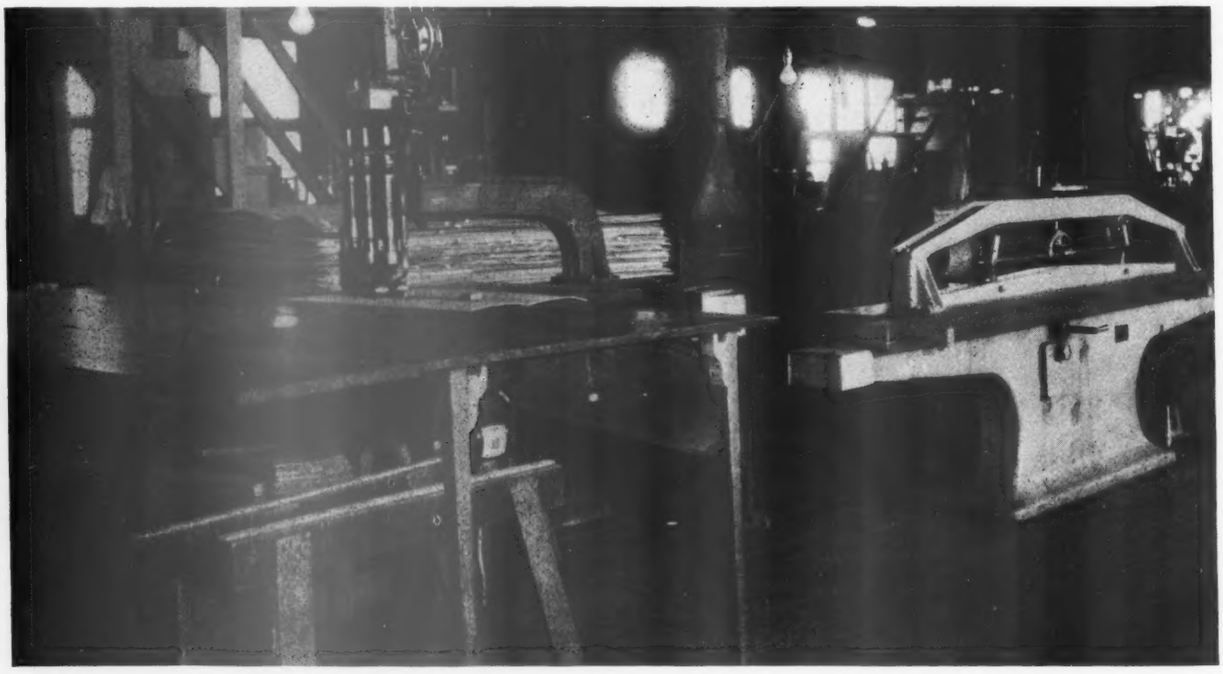
The taping machine and jointer are both shown in one illustration. The former consists of a suitable arrangement of belts and taper rolls which draw the veneer blanks together and automatically apply a special quick setting tape to the joint. This tape is made of white holland 1 in. wide, and staining is prevented by the absence of any dye material. The former method of temporarily joining veneer blanks was to nail the blanks to a work-bench and apply the tape by hand. This method was both laborious and relatively inaccurate, and, moreover, the nail holes permitted glue to work through under pressure in the hydraulic press and stain the panels.

In using the jointer, also illustrated, blanks of veneer are put on the table and clamped by the pressure bar shown. The table speed is about 20 ft. per min. forward and 50 ft. per min. return, the blanks being accurately cut at the edges by a high-speed saw with special teeth. The speed of this saw is approximately 6200 r.p.m., and the teeth are filed in such a way as to give a smooth cut. When veneer blanks cut on this jointer are matched, the joints are to all intents and purposes perfect and it can be readily appreciated how much of a saving is affected over former hand methods.

Method of cutting narrow strips from rubber or fabric rolls

Computation of Savings

In computing the savings made by these machines on the 18 converted suburban coaches mentioned, the average amount of material used per car was figured from the actual material manufactured, as recorded on regulation material slips; also, the labor cost of manufacturing the material was computed from the actual work-



Veneer blank taping machine in left foreground—Jointer at the right

ing time as shown on the shopmen's time slips. The savings shown were made between May 25 and November 10, 1928, on the 18 cars alone, savings made prior or subsequent to that period, and on other classes of equipment, not being included.

In manufacturing headlining, the labor costs were as follows: Hydraulic press, 4.7 cents; glue spreader, 0.3 cents; belt sander, 3.0 cents; taping and jointing, 3.0 cents per sq. ft., or a total labor charge of 11 cents per sq. ft. To this should be added the material charge of 4.8 cents per sq. ft. for veneer, and 1.2 cents per sq. ft. for glue, tape, paper, etc., making a total labor and material cost of 17 cents per sq. ft., which compares with a purchase price of 33 cents per sq. ft.

The average amount of headlining used per car was 900 sq. ft. or a total of 16,200 sq. ft. for the 18 cars. Consequently, the total savings on headlining may be computed as shown in Table I.

Table I—Total Savings Made on Headlining

Machine	Present cost per sq. ft.	Savings over old method	Total savings on 16,200 sq. ft.
Hydraulic press	4.7 cents	6.837 cents	$1,107.56
Glue spreader	0.3 cents	0.437 cents	70.76
Belt sander	3.0 cents	4.363 cents	706.84
Taping machine	2.0 cents	2.909 cents	471.23
Jointer	1.0 cents	1.454 cents	235.61
Total savings		16.00 cents	$2,592.00

In manufacturing 5-ply ply-wood for the 18 suburban coaches, the cost of jointing and taping by hand was

The hydraulic press—A great time- and labor-saver in forming headlining and manufacturing ply-wood

formerly 30 cents per sq. ft. as compared to 9.2 cents per sq. ft. with the present machine. The cost of operating the hand-screw press was 21 cents per sq. ft. as compared to 7.7 cents with the hydraulic press. The glue spreader affected a reduction from 3.0 to 0.6 cents per sq. ft. Scraping and sanding formerly cost 10 cents per sq. ft. as compared to 2.5 per sq. ft. with the present machine. The average amount of 5-ply ply-wood used per car for bulkheads, wall panels, basket panels, end panels and toilet partitions was 581 sq. ft., or 10,458 sq. ft. on the 18 cars. A summation of the figures quoted above indicates a present cost of manufacturing ply-wood of 20 cents per sq. ft. as compared to 64 cents formerly, or a net saving of 44 cents per sq. ft., which amounts to $4,601.52 for the ply-wood used in the 18 suburban coaches.

The removal of varnish from sash and finishing up the raw wood formerly cost 31.25 cents per sash by hand methods. By the use of an electric-driven drum sander, this cost of varnish removal has been cut to 6.25 cents per sash, the raw wood then being finished on the belt sander at a cost of 6.25 cents per sash, or a total cost of 12.5 cents per sash. This affects a saving of 18.75 cents per sash over the former method. The average number of inner and outer sash per car is 78, or

Table II—Total Savings Made on the 18 Suburban Cars

Machine	Cost New *	Savings on headling	Savings on plywood	Savings on sash	Total
Hydraulic press	$4,330.00	$1,107.56	$1,390.91	.....	$2,498.48
Glue spreader	150.00	70.76	250.99	.....	321.75
Belt sander	565.00	706.83	.....	$131.625	838.46
Taping machine	950.00	471.22	2,238.01	.....	2,709.24
Jointer	1,285.00	235.61	721.60	.....	957.21
Drum sander	224.00	.....	.....	131.625	131.63
Total	$7,504.00	$2,592.00	$4,601.52	$263.25	$7,456.77

* The cost new of each machine except the "home-made" glue spreader and the portable drum sander, includes a proportion of the cost of installing, estimated at $500.

1,404 for the 18 cars, making a total saving from the use of the drum and belt sanders of $263.25.

The combined savings of these machines made on the 18 suburban cars are shown in Table II.

Table II shows the amount that each machine saved on each class of work, and the total amount saved compared to the cost of the machine. The table shows that while some machines saved more than others in proportion to their cost new, the six machines in the aggregate practically paid for themselves in handling the work on the 18 suburban cars alone.

Another valuable labor-saving method at the Milwaukee cabinet shop is the equipment illustrated for cutting narrow strips from rubber or fabric rolls. These rolls are mounted on a framework, permitting the desired material to be brought over and down an inclined board to the table itself which is equipped with suitable metallic guides for a high speed electric-driven cutter

Home-made glue spreader which distributes glue uniformly on both sides of veneer

which cuts or trims the material uniformly and at a high rate of speed.

Adjustable material stops permit making the cuts without making measurements except for the first one, and thereafter as many strips as desired may be cut without difficulty. One man can cut more material with this equipment in two hours than he could by former methods in as many days.

Feeding Device for Air Motors

By L. V. Mallory

THE illustration shows a pneumatic feeding device that can be readily applied to any air motor without any alteration in the design of the motor other than the removal of the feed screw barrel, for which this device is substituted, and redesigning the drill ejector rod.

The device consists of a cylinder fitted with a telescoping, relaying piston assembly, the lower end of which is closed by the cylinder head. The cylinder has a comparatively short piston travel in relation to its diameter, as likewise has each unit of the relaying piston assembly. This feature permits a deep drilling range, while at the same time telescoping to a compact position when the air is exhausted, thus permitting the motor to be set up for drilling in close places. The outside circumference of the lug on the outside of the cylinder head is turned to the same outside diameter as that of the original feed screw barrel of the motor. The interior of this circular lug is bored and threaded precisely as the interior of the original feed screw barrel in order to engage with the feed screw stud within the motor. This arrangement provides for a suitable method of attaching the device to the motor.

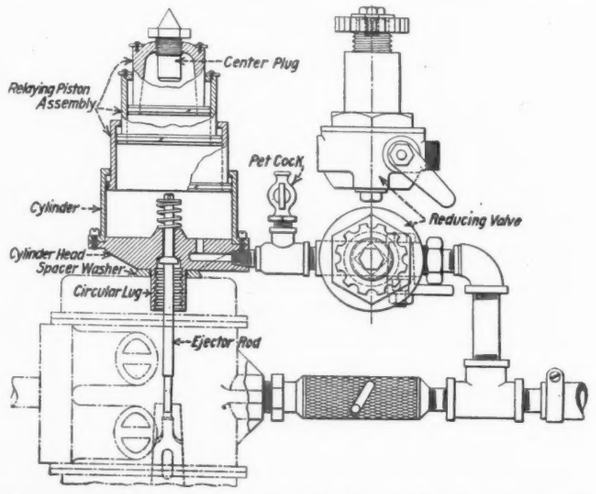
A spacer washer is placed around the lug so that when the device is screwed firmly into the motor, the air admission opening of the cylinder head lies parallel to the control handle of the motor. The length of the circular lug is sufficient to engage with the feed screw stud within the motor without resting on the last thread of the screw stud. Thus the tightening action falls entirely on the spacer washer.

The bore of the circular lug extends beyond the innermost thread, terminating in a conical seat. A 7/16-in. hole is drilled through the cylinder head. The upper end of the ejector rod, which is turned from a ¾-in. drill rod, passes through this hole. The upper surface of the collar on this rod is bevelled to correspond with the conical seat of the bore of the circular lug. This joint is ground to an air-tight joint, thus providing means of preventing the air from entering the spindle chamber of the motor from the feeding cylinder when sufficient thrust is applied to the ejector rod by the coil spring. This spring has sufficient tension to overcome what air pressure would be exerted against the ejector rod in ordinary use.

The length of the lower portion of the drill ejector rod is such that it clears the tang of a Morris taper shanked drill or socket and yet will reach the tang of the drill and eject it, when a sharp blow is struck, through the center plug when the piston assembly is telescoped.

The cylinder head contains a ¼-in. air admission port, the outer end of which is counter-drilled and tapped out to receive a ¼-in. pipe nipple.

The relay piston assembly consists of three units, a top, an intermediate and a bottom unit. The bottom and intermediate units are open at their upper ends. A circular shoulder on each arrests the motion of the piston within each when it reaches the end of its stroke. The top unit is closed at its upper end and is drilled and tapped for a ½-in. pipe thread.



Construction of the pneumatic feeding device for air motors

The skirt of each piston unit is machined to a close sliding fit within the cylinder in which it moves. Each skirt is grooved and fitted with a snap ring to insure an air-tight joint with the cylinder walls.

The top unit is fitted with a specially designed ½-in. pipe plug made of tool steel and is designed to terminate in a 60-deg. angle cone center point on its outer end, while its innermost projection forms a con-

tacting part to engage with the end of the ejector rod. The length of this inner projection is such that it will engage with the ejector rod and thus eject the drill when the piston assembly is about ¼-in. from its telescoped position.

The device is connected to the main air supply as follows: A ¼-in. nipple engages with the threaded opening of the cylinder head, connecting with a ¼-in. by ¼-in. by ⅜-in. reducing tee. The reducing tee, in turn, is connected to an air reducing valve by a ⅜-in. nipple. The remainder of the piping arrangement is shown in the illustration.

The purpose of the reducing valve is to control the air pressure within the feeding device when using different sizes of drills, drilling in metals of different hardness or reaming, which requires comparatively low pressure and rapid feeding. Also owing to the fact that each relayed piston necessarily offers less area for the compressed air to act on, an increased air pressure must be introduced at each relay action to insure uniform pressure on the drill.

A ¼-in. pet cock is screwed into the reducing tee that connects into the cylinder head. This affords a means of readily exhausting the air from the device when it is desired to collapse it when moving the drill to a new location. It also is of advantage in quickly reducing or controlling the pressure to prevent crowding of the drill at the moment it breaks through the metal.

Two retainer rings are attached to the tops of the top and intermediate piston units so as to maintain these members in functional position within their surrounding members when the air is released.

The principle of this device is simple. When air is admitted to the cylinder, it causes the relay piston assembly to move upward until the skirt of the bottom piston unit is stopped by the shoulder of the cylinder. The motion is still continued until the intermediate piston unit is also arrested by the shoulders of bottom unit. This motion is further relayed by the top piston unit until it is arrested by the shoulders of the intermediate unit which completes the stroke.

By substituting the cone center plug with one having ¾-in. pipe threads on its outer end, it may be engaged with the threads of a 2-in. by 2-in. by ¾-in. tee with large threads reamed out smooth so that it may be slid along a 1¾-in. rod supported parallel over a row of staybolts or saddle bolts. Thus, a safe and efficient means is provided for these drilling operations.

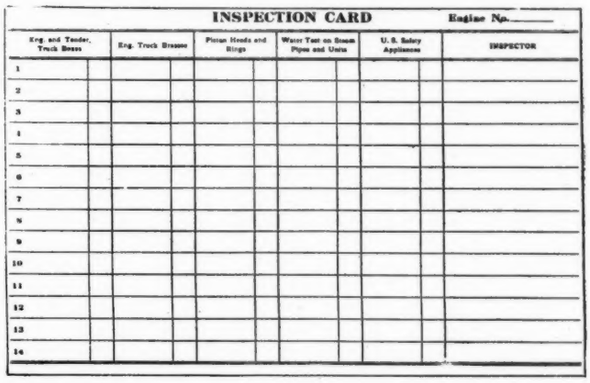
Bangor & Aroostook Inspection Cards

IN addition to the regular monthly washout and yearly hydrostatic inspection forms kept in the locomotive cabs, the Bangor & Aroostook has added a third inspection form on which are columns headed, "Engine and tender truck boxes," "Engine truck brasses," "Piston rings," "Units and steam pipes tested under water pressure," and "United States safety appliances." The last column to the right provides a space for the signature of the inspector. The purpose of this card is to keep a close check on the inspection of some of the more important locomotive parts and to prevent duplicate work relative to these parts. At the right of each space for noting the dates of inspection is a narrow column, in which is placed the station symbol of the place at which the inspection was made.

Two inspectors are not allowed to use the same line. For example, the inspector at Northern Maine Junction inspects the engine truck brasses on a certain date. On line No. 1, he places the date of inspection under the heading "Engine truck brasses;" after it, in the narrow column, the station symbol, and at the extreme right, his signature. When the locomotive goes to another terminal, the piston rings are inspected. The inspector at this point will use line No. 2 in the column under the heading marked "Piston rings." The station symbol and the inspector's signature are also entered on line No. 2.

When the last line of any inspection card is used, the card is removed from the cab, and the complete record of the last inspection made under each heading is entered on a new card. The old card is sent to the office of the mechanical superintendent, where it is placed on file.

The engine and tender truck boxes are examined once each week, except those boxes equipped with the Hennessey oilers. The cellars in these boxes are taken down and examined once every month, but the oil reservoirs are examined once each week and the notation "Oiled" is placed over the date on the inspection card. On engine truck boxes, the pins are removed, the cellar dropped and the packing put in proper shape. The oil pump in the Hennessey oilers is tried each time the boxes are dropped.



INSPECTION CARD — Engine No.____

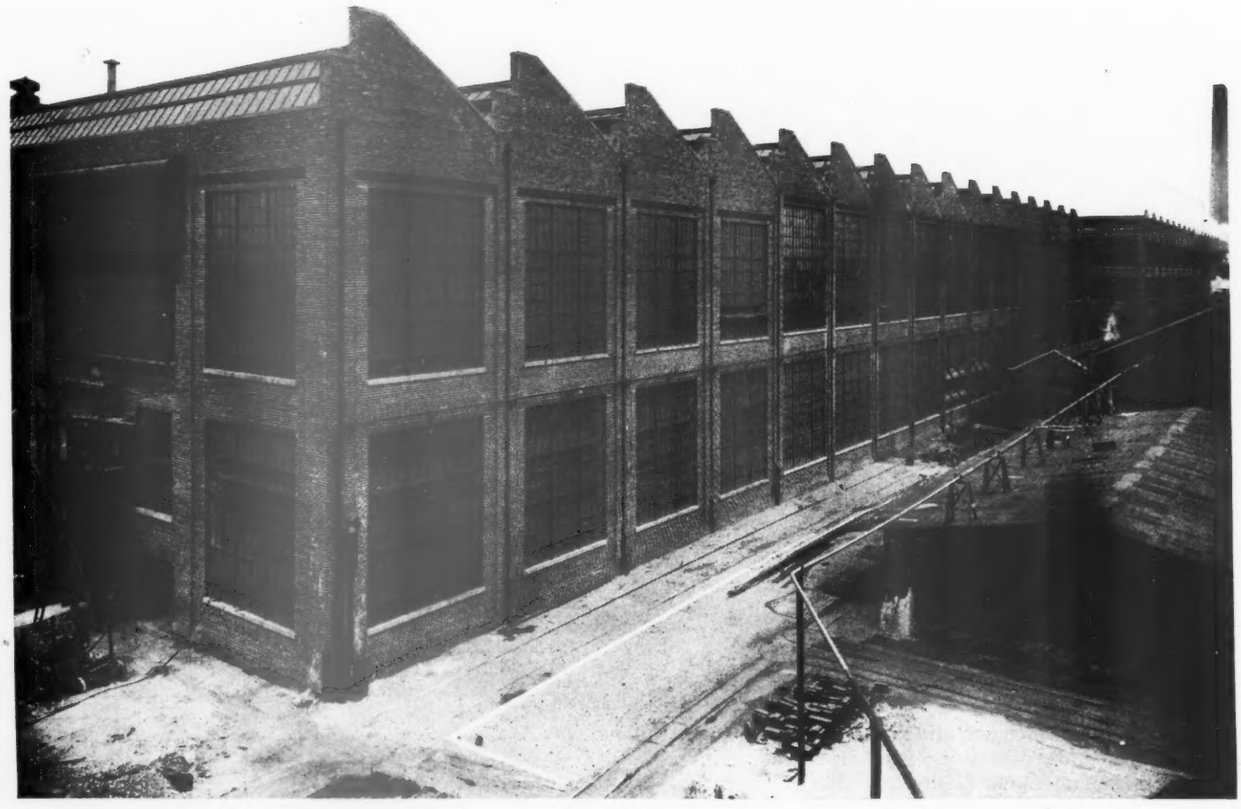
	Eng. and Tender Truck Boxes		Eng. Truck Brasses		Piston Heads and Rings		Water Test on Steam Pipes and Units		U. S. Safety Appliances		INSPECTOR
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											

An inspection card which is kept in the cabs of Bangor & Aroostook locomotives

The engine truck brasses are removed, examined, repaired or renewed once every two months, except those on locomotives equipped with Hennessey oilers. The engine truck brasses in boxes equipped with these oilers are removed from the boxes and examined once every six months.

The pistons and rings are examined once every three months and renewed, if necessary. The steam pipes and exhaust stands on saturated locomotives and the same parts in addition to the units on superheated locomotives, are tested with water pressure once each year. The United States safety appliances are checked once each month and any necessary corrections made.

The above inspection does not interfere in any way with any of the regular inspections given to the locomotives. In other words, these compulsory company inspections are in addition to the inspections required by federal law. These additional inspections have resulted in better maintenance and a considerable reduction in engine failures.



Machine Shop of the Norfolk & Western, Roanoke, Va.

The Norfolk & Western Machine Shop at Roanoke

Efficient management and operation secure results from modern tools and a well-arranged shop

THE new machine and locomotive erecting shops of the Norfolk & Western, Roanoke, Va., were completed in the latter part of 1926, and placed in complete operation in the early part of 1927. The new shops are located on the same ground formerly occupied by the old shops. Wrecking of the old buildings was carried on over the heads of the men operating machine tools and working on locomotives, and the new buildings were erected under the same conditions.

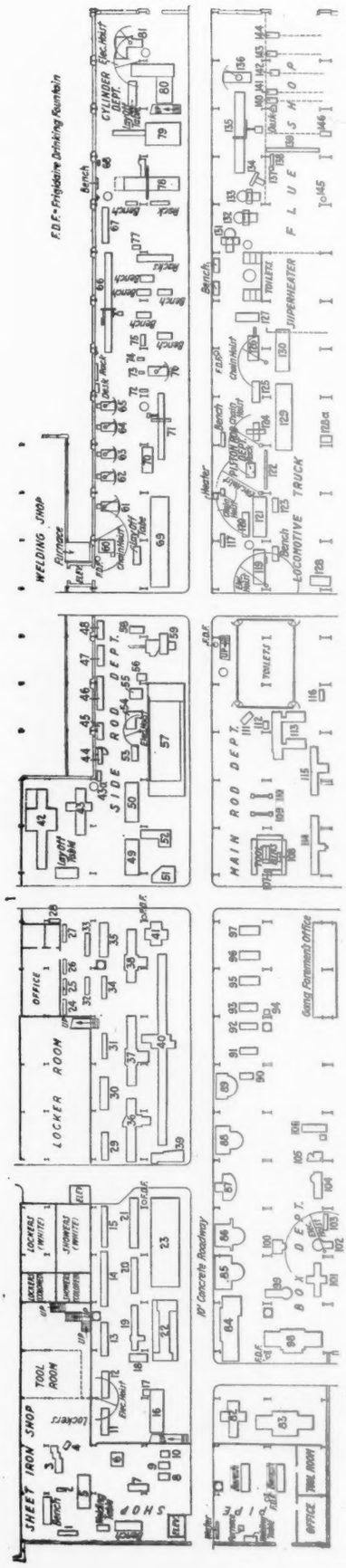
Heavy machines were often moved on short notice from one place to another during the dismantling and erecting operations, so as not to interfere with the work of the building contractors. An excavation or building scaffold frequently occupied the spot where a boring mill or lathe had been operating twelve hours before. Machine tools and finished parts were protected from the elements by temporary sheds or tarpaulins, and as soon as a section of the new building was completed, it was immediately occupied. The first section was completed and occupied early in 1925. Succeeding sections were occupied as soon as completed, and the new shops were in partial operation from the time the first section was completed until the building contractors finished their work in 1926. Final organization of the operation on a permanent basis was not effected, until all the machine tools and equipment had been located in their respective departments in 1927. No time was lost at Roanoke in taking care of all class repairs during the period of transition from the old to the new shop.

The Machine Shop Has 161,827 Sq. Ft. of Floor Area

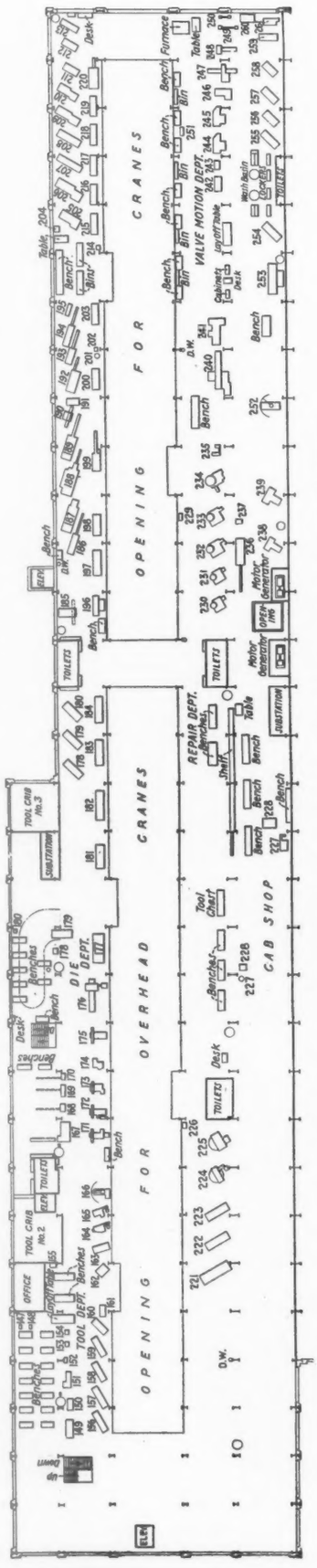
The machine shop building occupies 131,000 sq. ft. of ground and has a total floor area of 161,827 sq. ft. Of this area, the main floor has 67,648 sq. ft., the main balcony, 58,763 sq. ft.; the first balcony, 10,028 sq. ft., and the third balcony, 11,245 sq. ft. The building is 682 ft. long by 123 ft. wide, with a balcony on the south side next to the erecting shop and three balconies on portions of the north side.

The general construction consists of a concrete foundation, brick walls with steel columns and roof trusses carrying a built-up roof of saw-tooth construction. The lighting arrangement has proved particularly efficient. The windows and sky-lights are of steel sash construction and are as large as space permits. All sash are glazed with ribbed wire glass. Lights of ade-

(1) Manufacturing department on the main balcony—(2) Tool manufacturing and repair departments—(3) Valve motion department—(4) Another view of the manufacturing department—(5) Northeast corner of the main balcony—(6) View from the west end of the main floor—(7) Links and valve motion



Machine tool layout on the main floor



Layout of the departments and machine tools on the main or second balcony

quate candle power are provided throughout the shop for night work. These are controlled by individual switches so that adequate lighting can be furnished for any part of the shop without turning on all of the lights. The main floor is paved with wood blocks on a concrete base, while the balcony floors are of concrete with Colman finish.

The Main Floor

One of the drawings shows the location of the various departments and machine tool layout for the main floor. This floor is occupied by the larger and heavier machines. One end of this floor is used for the pipe shop. The box, main rod, truck, superheater and flue departments are located in the machine shop adjacent to the erecting shop. There is no dividing wall or partition between these departments and the erecting shop.

Study of the tool layout for the main floor will show that the various departments are well located with respect to each other, and that the tools and apparatus have been carefully laid out in each department. For example, the wheel lathe, No. 83, the boring mill, No. 82, and the wheel press and quartering machine, No. 16 and No. 22, respectively, are located at one end of the shop next to the pipe shop. This location eliminates the possibility of tying up overhead crane service, as would be the case if these machines were located in the center of the main floor. This floor is served by five 10-ton traveling cranes. Thus, if one is being used at the wheel lathe or quartering machine, the remaining four can still serve all the other departments extending from the quartering machine to the far end of the shop.

The routing of different parts and materials can readily be traced by comparing the list of machine tools located on the main floor, with the layout drawing.

The locker rooms, showers, a section of the iron and tin shop, and the pipe shop on the main floor are located under the first balcony, which is 13 ft. above the main floor. This balcony extends across the west end of the shop and 276 ft. along the north side.

The First Balcony

The floor of the first balcony across the end of the shop is 123 ft. by 42½ ft. and contains the sheet iron and tin shop only. The remaining portion of the first bal-

cony, on the north side of the shop, is 234 ft. by 20½ ft., which is taken up by the office for the machine shop foreman, the shop blue-print filing room, wash and locker rooms, and storage.

The Main or Second Balcony

The main or second balcony has a total floor area of approximately 59,000 sq. ft., and on this is located the tool, valve motion, brass fitting and automatic machine departments, as well as other lighter classes of machine work. From all practical purposes, it could be considered to be the second floor of the machine shop building, for it extends around all four sides of the building.

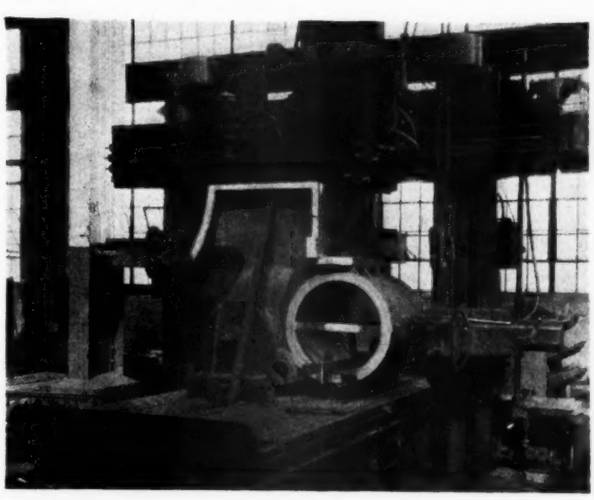
The openings in the center of the machine shop provide for the operation of the 10-ton overhead cranes. The main balcony is 26½ ft. above the main floor,

List of Machine Tools and Equipment Located on the Main Floor

1	Air clamp
2	Tool grinder
3	Bending rolls
4	Drill press
5	Punch and shear
6, 7, 8 and 10	Pipe threading machines
9	Pipe cutting machine
Wheel, Axle and Frame Section	
11, 12, 13, 14 and 15	Lathes
16	Wheel Press

This photograph shows the difficulties encountered in handling locomotive repairs during the dismantling of the old shops and the erecting of the new

17	Double floor grinder
18	Shaper
19	Milling machine
20, 21, 24, 25, 26 and 27	Lathes
22	Quartering machine
23	Double head frame slotter
28	Centering machine
29, 30, 32 and 33	Lathes
31	Boring, drilling and milling machine
34 and 35	Horizontal boring mills
36, 37, 38, and 40	Planers
39	Metal cutting saw
41	Milling machine
57	Double head frame slotter
82, 85, 86, 88 and 89	Boring mills
83 and 98	Wheel lathes
84	Axle lathe
87	Radial drill press
Side Rod Department	
42 and 43	Horizontal milling machines
43a	Double floor grinder
44, 45, 46, 47 and 48	Lathes
49	Rod boring machine
50	Double head drill press
51	Metal cutting saw
52 and 58	Drill presses
53	Power bushing press
54	Grinder
55	Vertical lathe
56	Internal grinder
59	Boring, drilling and milling machine
Main Rod Department	
107 and 108	Tool grinders
109 and 110	Swing grinders
111	Milling machine
112	Double floor grinder
113, 114 and 115	External grinders
116	Lathe
Piston Rod Department	
117	Double floor grinder
119	Planer
120	Press
121	External grinder
122 and 125	Lathes
124	Milling machine
126	Horizontal boring machine
127	Slotter
131, 132 and 133	Boring mills
134	Milling machine
135	Open side planer
136	Radial drill
Locomotive Truck Section	
123	Boring mill
128	Metal cutting saw
128a	Double floor grinder
129	Truck wheel lathe
130	Lathe
Cylinder Department	
68	Double floor grinder
78	Planer
79	Horizontal boring machine
80	Horizontal boring and milling machine
81	Radial drill
Box Department	
99, 100 and 105	Vertical lathe
101	Milling machine
102	Radial drill
103	Press
104	Slotter
106	Shaper
Manufacturing and Miscellaneous Tools	
60	Drilling machine
61, 62, 63, 64, 65, and 76	Radial drills
66	Planer
67	Wheel press
69	Double head drilling machine
70	Lathe
71	Planer
72	Double floor grinder
73, 74, 75, and 94	Drill presses
77	Milling machine
90, 91, 92 and 93	Shapers
95, 96 and 97	Slotters
Flue Shop	
137	Swedging machine
138	Furnace
139	Flue tester
140	Rolls
141	Welder
142 and 145	Double floor grinders
143	Scarfer
144 and 146	Flue cutters



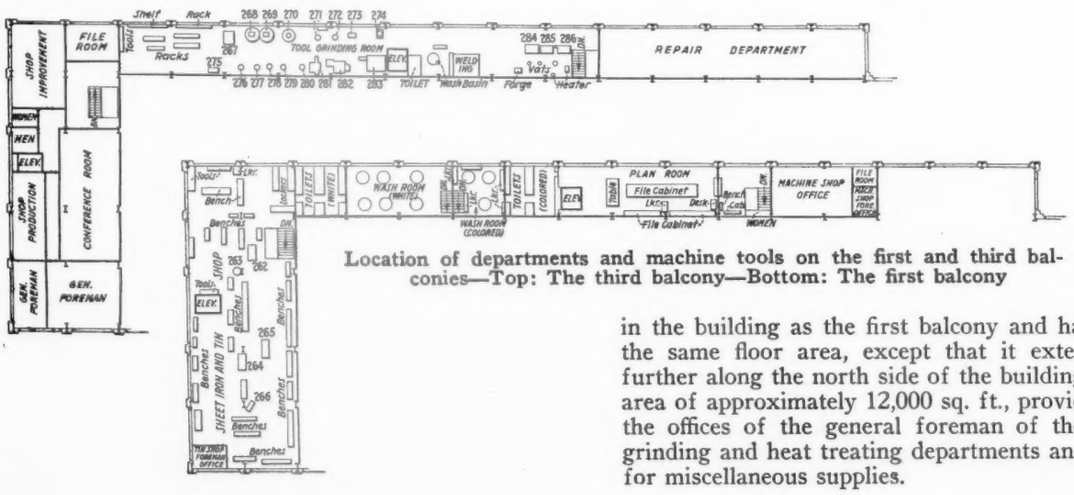
Machining a cylinder casting

which affords adequate head room underneath for the installation and operation of two-, five-, and ten-ton overhead cranes, serving departments on the main floor. The height from the floor of the main balcony to the roof girders is 27½ ft., which also affords ample head room for the operation of two- and five-ton traveling cranes.

List of Machine Tools and Shop Equipment Located on the Main Balcony

TOOL DEPARTMENT

149, 150, 151, 156, 157, 158, 159 and 167	Lathes
152	Double floor grinder
153 and 154	Drill presses
161	Power press
162	Slotter
163, 164 and 165	Shapers
166	Radial drill
168, 169 and 170	Metal cutting saws
171, 172, 173, 174 and 175	Milling machines



Location of departments and machine tools on the first and third balconies—Top: The third balcony—Bottom: The first balcony

DIE DEPARTMENT

176	Planer
177	Lathe
178	Double floor grinder
179	Shaper

LIGHT MANUFACTURING STATION AND MISCELLANEOUS TOOLS

178, 179, 180, 181, 182, 183, 184, 196, 197 and 198	Lathes
185, 190	Milling machines
196	Grinder
199	Screw machine
186, 187, 188 and 189	Automatic machines
192, 193, 194	Turret lathes
195	Centering machine
200, 203, 205, 206, 207, 208, 209, 210, 211, 212, 213, 215, 216, 217, 218, 219 and 220	Lathes
201	Oil groover
202	Marker
214	Drill press
221, 222 and 223	Lathes
224 and 225	Boring mills
226	Double floor grinder
229	Double floor grinder
230, 231, 232, 233 and 234	Vertical turret lathes
235 and 237	Drill presses
236	Lathe
238 and 239	Universal milling machines

CAB SHOP

227	Double floor grinder
228	Drill press

REPAIR DEPARTMENT

227	Metal cutting saws

VALVE MOTION DEPARTMENT

240 and 241	Milling machines
242, 243, 244, 245, 246, 247 and 253	Grinders
248	Drill press
249 and 250	Swing grinders
251	Power press
252	Radial drill
254, 255, 256, 257 and 258	Lathes
259	Slotter
260 and 261	Metal cutting saws

The automatic machine department is primarily a manufacturing department and is located on the main balcony on the north side of the shop opposite the valve motion department. It extends from the cross-over to the east end of the shop. The list of machine tools and equipment on the main balcony is given in one of the tables.

List of Machine Tools and Shop Equipment Located on the First Balcony

262	Circular shears
263	Double floor grinder
264	Shears
265	Roofing machine
266	Stencil machine

The Third Balcony

The third balcony occupies the same relative position in the building as the first balcony and has practically the same floor area, except that it extends 73½ ft. further along the north side of the building. The total area of approximately 12,000 sq. ft., provides space for the offices of the general foreman of the shops, tool grinding and heat treating departments and for storage for miscellaneous supplies.

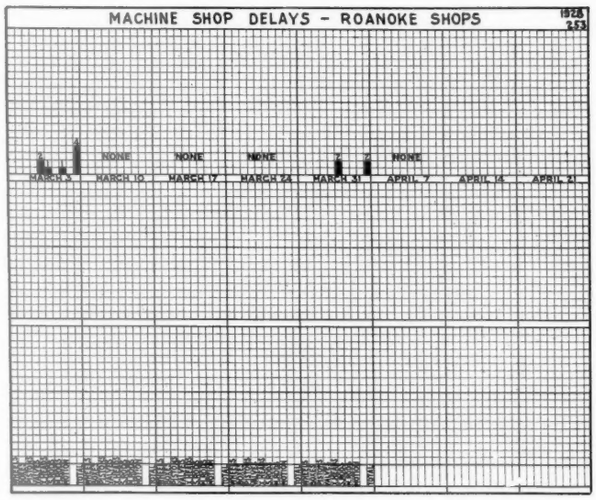
Handling and Routing of Material

The entire length of the center portion of the main floor with the exception of the pipe shop, is served by five 10-ton overhead electric traveling cranes and the bays on the main floor to the north and south are served by either two- or five-ton overhead traveling cranes, electrically operated. The runways for the 10-ton cranes in the main or center bay extend outside of the building through an opening provided with a motor-operated steel door. The runway for the cranes from the shop extends over another runway at right angles to it, on which another 10-ton overhead crane serves a large material-storage yard. Material can be handled by this overlapping system of overhead traveling cranes from the storage yard to practically any point in the building, the south bays of the main balcony also being provided with two- and five-ton traveling cranes and the north bays with two-ton cranes. The location of the five-and two-ton cranes in the north bays of the main floor and in the main balcony, respectively, makes

List of Machine Tools and Shop Equipment Located on the Third Balcony

267, 268, 269, 270, 271, 272, 273 and 274	Tool grinders
275	Saw sharpener
276, 277, 278, 279, 280, 281, 282 and 283	Tool grinders
284, 285 and 286	Heat treating furnaces

it possible to deliver material to landing platforms on the first and third balconies. Landing platforms are provided on the main balcony for receiving material from the cranes operating in the center bay. In addition to the cranes, three elevators are provided to handle material on trucks from floor to floor.



Delays to work going through the machine shop during the weeks from March 3, 1928, to April 7, inclusive

Electric and gasoline trucks and trailers are provided for handling material about the shop. The trailers can be carried from floor to floor, either by crane or by elevator. Easy operation of the trucks has been assured by laying concrete roadways in the wood block pavement on the main floor. Truck routes have been established and the traffic lanes marked so that they will not be blocked by material piled on the floor. A crossover has been provided near the center of the shop, which connects the north and south sides of the main balcony.

The location of the machine shop between the smith and erecting shops, and the longitudinal layout of the shop itself, facilitate the locating of repair and manufacturing departments convenient to the point of assembly in the erecting shop, or to the delivery of material for shipment to outside points.

The outstanding features of this shop are the arrangement of departments with their respective machine tools and equipment to reduce the handling of materials to a minimum, adequate overhead crane service, and the fact that each section or department is supplied with all the necessary machinery and facilities for completely handling its portion of the work.

Machine Tools and Shop Equipment

Practically all of the machines in the shop are of modern design and are equipped with individual motor drives. A large number of the older machines have been modernized: Drill presses have been equipped with high-speed heads, lathes with push button control, etc. In fact, considerable study has been given to the problem of obtaining modern production rates from old machines through the purchase of parts that will either increase the speed of the machine itself or provide easier and faster operation by the operator. Each machine is labeled with a strip of tin or copper, on which the name of the operator is stamped in raised letters.

An important factor in the production work of this shop is the character of jigs and fixtures. The design of jigs and fixtures is under the supervision of the shop production department. This department devotes a large part of its time to the study, design and selection of jigs and fixtures. Ideas suggested by any man in the shop are carefully considered and, if possible, improved. The design considered to be the best for its

View of the main floor from the east end of the shop

purpose is made standard for the road. Descriptions of some of the jigs and fixtures standard on the Norfolk & Western have already been published in the *Railway Mechanical Engineer.*

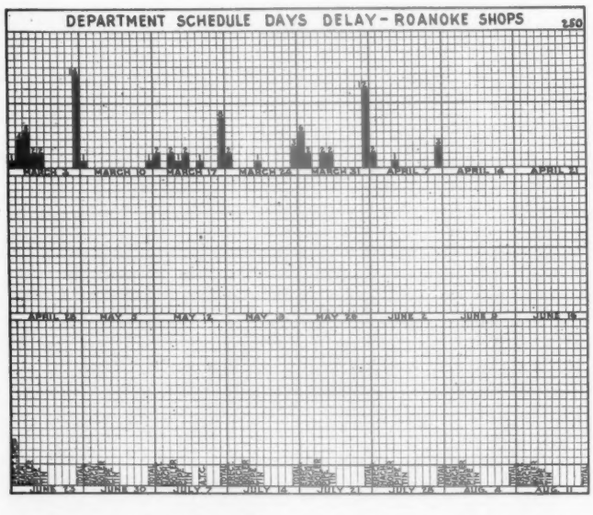
The tool cribs are equipped with steel shelving, bins, etc., a large part of the shelving being equipped with sloping drawers. Each drawer or shelf opening is provided with a label holder with the name and number of parts carried therein so that the contents may be ascertained at a glance. Wash rooms, toilets and locker rooms are located at convenient points throughout the shop. Each man is provided with a ventilated steel locker and he is required to keep it in an orderly condition. The wash basins are of the 10-man community type.

The shop is completely equipped with electric-power, steam, air, water and gas outlets. The drinking fountains are cooled by the Frigidaire system. The building is heated by unit hot blast heaters, distributed along the walls. These heaters are motor-driven and a uniform temperature can be maintained in very severe weather.

The office of the machine shop foreman, which is located on the first balcony, is practically all of sash construction so that the foreman has an unobstructed view of a large portion of the main floor. Adjacent to his office is a blue-print filing room, called the "plan room" where all blue prints are indexed and filed. Blue prints are issued to the men by a check system, similar to that customarily used in issuing tools. All prints are returned when the job for which they were drawn is finished. This system eliminates the circulation of drawings that have been revised, as the plan room destroys all prints on the receipt of revised prints.

Organization and System of Operation

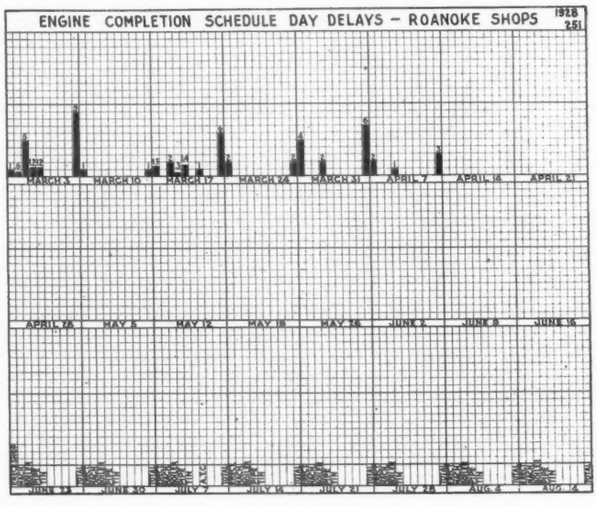
The machine shop force consists of a total of 491 men, including clerks and foremen. The organization



Delay report of the different departments showing the number of days behind schedule

includes one foreman who has supervision over the entire machine shop, one toolroom foreman and one night machine-shop foreman. Eleven assistant foremen and eight gang leaders supervise the work of the various sub-departments and special gangs. In addition to meeting the requirements of the locomotive erecting shop, the machine shop does considerable manufacturing on shop orders for the stores department, and performs a large amount of work for the maintenance of way and car departments. All of the manufacturing work is in charge of an assistant foreman. The lathe work, brass finishing, bolt manufacturing, etc., is done on the main or second balcony, and all the heavy manufacturing is done on the main floor.

The repair department, which is located on the third balcony, employs two millwrights and four helpers. In addition to the shop repair work, these six men per-



Weekly report of engine delays from the various departments

form all the repair work on plumbing, heating systems, etc., at all the passenger stations on the line, offices and also the Hotel Roanoke, Roanoke, Va., which is owned and operated by the railroad company. The bronze and babbitt department is located in a small building adjacent to the machine shop and is equipped with a furnace and a one-ton electric jib crane.

The tool department is located on the main and third balconies. Tool grinding and heat treating is performed on the third balcony, while the manufacturing toolroom is located on the main balcony. Tool cribs for issuing tools are located on the main floor, main balcony and in the manufacturing toolroom itself. All tools are issued on a check system, and all tools must be accounted for on each Saturday.

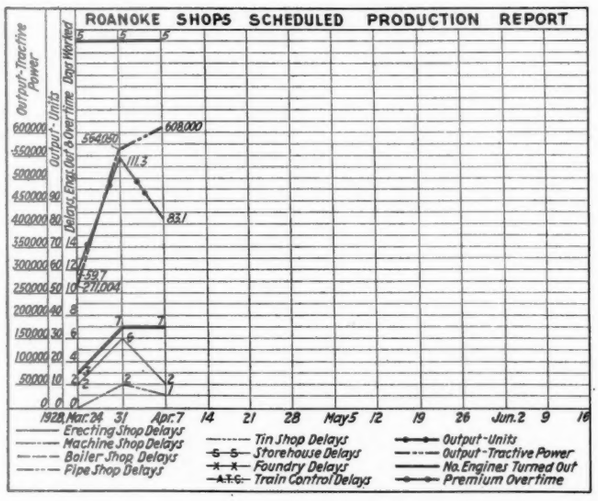
The tool department makes all the dies used by the smith shop for heavy work, for which special die steel is used. This department is provided with a two-ton overhead traveling crane, and the die section is provided with a one-ton hoist, which operates on an overhead monorail system to various parts of the section.

The Shop-Order System

Orders for work on the machine shop are handled in the following manner. Five copies of each shop order are made, all of which are sent to the office of the machine-shop foreman. One copy is retained for the machine-shop foreman's office, one goes to the shipping department, and the remaining copies are sent to the department foremen concerned. The class of repairs authorized for locomotives coming into the shop is authority for the machine shop foreman to perform the necessary work. If it is discovered that certain additional work should be performed which is not included in the repairs authorized, the machine-shop foreman cannot proceed with this additional work until the re-

pair classification originally authorized has been changed to meet the new requirements.

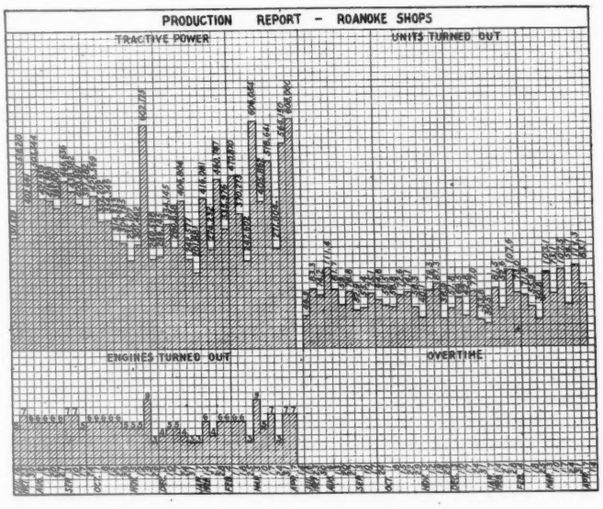
Each department in the shop receives a certain number of work credits which goes through the shop, the number depending on the repair classification and the class of locomotive. This figure is carried on the scheduled production report, the form for which is



Form showing the weekly production in tractive force, man-hours and number of locomotives together with delays and overtime for the different departments

shown in one of the charts. At the present time, each unit represents approximately 290 man-hours. This figure can be changed at any time to meet new conditions that may arise.

In addition to the weekly report on scheduled production, reports for the same period are maintained for the delays to locomotives going through the shop, and delays to locomotive parts going through the machine



Consolidated weekly report of the locomotive repair shops

shop. A master schedule board is kept up to date in the scheduling department, and schedule boards are also maintained in those departments playing an important part in production; such as the driving box and wheels, rods, motion work, and cylinder departments. These boards show the scheduled time set for the department to perform its quota of work on each locomotive in the shop, delays, if any, and the causes for the delays.

The production report forms are shown in five of the illustrations. It will be seen that the management keeps a record of the total pounds tractive force turned out of the shop, in addition to the output in units, the locomotives turned out and any overtime incurred. The tractive force output figure affords a very good comparison of shop production over an extended period of time for the Roanoke shops, since practically all of the locomotive repairs at that point are confined to a few classes, mostly of the articulated type.

The data shown on three of the production forms, gives the production figures of the Roanoke shops during March and April of 1928. The consolidation report gives comparative figures in tractive force, units (man-hours) and in locomotives from July, 1927, to April, 1928. The machine-shop portion of this work, in addition to a large amount of manufacturing work, is performed by the force of 491 men.

Spiral-Fluted Locomotive Reamers

SPIRAL-FLUTED taper locomotive reamers are effecting material savings over the straight-fluted reamers formerly used in the main locomotive shops of a Class I railroad, according to a survey made recently by the A. C. Nielsen Company, engineers, Chicago, in collaboration with and approved by the shop supervisor and superintendent of motive power of the railroad. The reamers now used are made in accordance with the specifications of the American Railway Tool Foremen's Association, and are used principally on holes 1-1/16 to 1-11/16 in. in diameter. The new reamers were first adopted because tests showed that, as compared with straight-fluted reamers, they produced a much smoother hole, would stand faster cutting speeds, and could be handled much more easily by the operators.

Subsequent use has shown that the spiral-fluted tools give at least twice as many holes per grind and can be ground nearly twice as many times as the straight-fluted reamers. The initial costs are nearly the same for both types but the longer useful life of the new reamers makes their final cost about 72 per cent less.

Comparative Reamer Performance

For locomotive frame work the reamers are chucked in air motors. The straight-fluted reamers formerly used were sources of considerable trouble because of their tendency to grab or hog in. This was inherent in the straight-flute design and made it necessary for the operator to hold back steadily on the air-motor grips. Even the most experienced mechanics in the shop were unable to avoid jamming these reamers and sections of the lands were frequently broken out. When a section of one land had been chipped it was a matter of only a few holes until the lands broke away all around the reamer at that particular section, thus ruining the tool. Another very common source of trouble was the fact that flute marks were invariably left on the finished surface whenever a reamer was stopped in a hole.

Both of the above difficulties have been eliminated by the use of spiral-fluted reamers. With the reamer rotating opposite to the direction of the flute spiral, there is no tendency for the reamer to draw itself into the

hole. The operator can control the feed easily and within close limits by varying the pressure applied to the motor grips.

There is no record of chipping or breakage on any spiral-fluted reamer used at these shops, a natural result of the fact that the spiral design eliminates jamming and makes possible wider and stronger lands.

The toolroom foreman summarizes the advantages of the spiral-fluted reamers over the straight-fluted reamers as follows:

1—The spiral lands are wider and make a generally stronger tool.
2—The flutes are deeper, thereby permitting more grinds per reamer.
3—Increased land strength and easy control of feed eliminates chipping and breakage.
4—The mechanic's work on reaming jobs is much easier.
5—Less time is lost in freeing jammed reamers and in going back to the crib for new tools.
6—Cutting speeds are faster.
7—Finished holes are smoother.
8—The number of holes per grind is increased.

The advantages of the spiral-fluted reamers are concretely illustrated on a typical job in which a 1-1/16-in. by 12-in. drilled hole is reamed to a taper of 1/16 in. per foot (on the diameter) in Hylastic steel. This work is done with a spiral reamer of 16-in. flute length. The speed is 247 r.p.m. and the actual reaming time is 2.4 min. at a feed of about 5 in. per min.

The straight-flute reamers formerly used for such jobs could not safely be run at more than 125 r.p.m. The maximum feed was one inch per minute and the actual reaming time was five times the present figure owing to the care with which the work had to be done.

Reduction of Reamer Cost

The 1-1/16-in. spiral-fluted reamers cost $9.36 net at these shops and the grinding cost during the life of each tool is about $4.50. The total direct cost is thus $13.86 per reamer.

Straight-fluted reamers of the same size cost $11.70 each. Grinding cost averages $2.25 during the life of tool and the total cost is thus $13.95. On the basis of the number of holes reamed, one of the spiral-fluted reamers is equal to between three and four straight-fluted type.

Taking 3-½:1 as a fair average ratio, the reamer costs are:

Straight-flute—3.5 times $13.95 equals	$48.82
Spiral flute—1 times $13.86 equals	13.86
Net saving (72 per cent)	$34.96

The net saving noted above is 2.5 times the entire cost of the 1-1/16-in. spiral-fluted reamer and the user is confident that corresponding gains are being made on all other sizes. It is not possible to calculate the saving of labor due to the use of the spiral-fluted reamers although it is clear, from the difference of feeds and speeds used, that a substantial gain is being made.

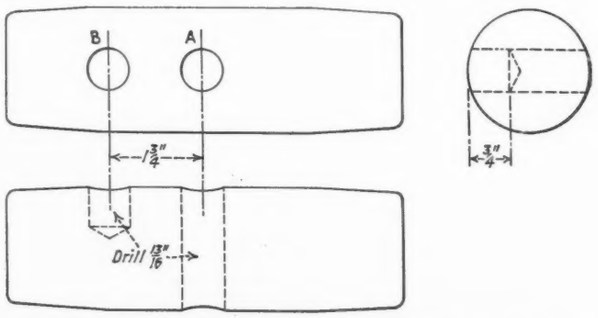
The list of advantages actually observed in the operation of spiral-fluted reamers is good evidence of the satisfaction they are giving. The toolroom foreman says that the spiral reamers give a "gun-barrel" finish.

MILLING CUTTERS.—The 40-page catalogue, Bulletin 49, of the Ingersoll Milling Machine Company, Rockford, Ill., illustrates all of the standard, and many of the special types of Ingersoll milling cutters which represent a wide range of adaptability, including face milling cutters for milling cast iron, steel, and aluminum; heavy helical cutters for slabbing alloy steel; solid shank cutters for contour milling, and a number of types designed for specific operations.

Coupling Pin for Stoker Conveyors

ON the later types of Duplex stokers, the conveyor ball joint clamps have been replaced by a conveyor coupling pin. When coupling the stoker, after the tender has been separated from the engine for any reason, difficulty is sometimes encountered in working the coupling pin into position so that the cross, or handling pin may be put in place.

At some enginehouses it has been customary to loosen the coupling pin in the hole by cleaning out the dirt, and to block up the coupling pin a short distance with a



Sketch showing the additional hole "B" drilled in Type D-2 and D-3 Duplex stoker conveyor coupling pins to facilitate placing in correct position for coupling

stick while the tender is uncoupled and backed away from the engine. Then when the coupling is made and the conveyor ball joint is again in position, the coupling pin is forced up into position with a short 7/8-in. round bar, with one end bent at right angles 1½ in from the end. There is some chance that, while this work is being done, the hole through the coupling pin will be twisted out of line with the holes in the transfer hopper. Sometimes the stick holding the pin is knocked out or jarred loose, causing trouble.

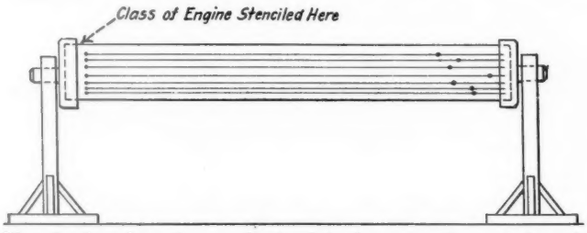
If this stoker pin has an extra hole drilled part way through, as shown at B in the sketch, the coupling of the conveyor of the transfer hopper can be performed much more easily. After the pin has been loosened, it should be set in such a position that the cross pin will enter the hole *B* and keep the coupling pin in proper alinement and at the correct height to make the stoker coupling easy. This will keep both the coupling and keeper pins where they belong.

Keeping Correct Master Rod Lengths

PRACTICALLY every railroad shop has a problem in keeping correct master rod lengths for setting trams to check the length of side rods and to check the distances between wheel centers. These lengths are different for different classes of engines and, in some cases, different lengths are used for tramming different wheels on the same engine. It is neither convenient nor accurate to set off a rod tram with a steel tape every time a certain length is required. In the smaller shops,

the rod lengths most frequently used are often laid out and prick punched on the side of the planer table, and the class of engine for each respective length is stenciled near the punch marks. Back shops use square or round rods with a smooth finish, with several of the rod lengths laid out and lightly punched thereon. These measuring bars are kept in a rack near the rod bench and are constantly referred to in setting trams.

After some study, one large shop in the west adopted the following plan to obtain a permanent and convenient record of the correct rod lengths on all classes



Sketch showing the method of laying out the rod lengths and the construction of the horses and trunions

of engines used on that road. A piece of 12-in. well casing was obtained, somewhat longer than the longest rod length to be used. A pipe cap was screwed on each end of the casing. A piece of a 2½-in. round iron, about 6 in. long, was welded at the center of each pipe cap to provide trunnions or supports, so that the casing could be conveniently supported and easily turned. This assembly was then placed in a lathe and the casing turned and smoothly polished.

Parallel lines were scribed the length of the casing, about an inch apart, using the point of the lathe tool to aid in lining up the marks. A heavy line was then scribed all around the casing near one end to serve as a base line in locating one end of each rod length. This assembly was mounted on small horses, as shown in the sketch, near the rod bench. Two old reverse shaft bearings were used to support the trunnions. This device has been in use for four or five years.

Booster Clutch Piston Puller

MANY of the mechanics in enginehouses and erecting shops who work on boosters have found that frequently the booster clutch-cylinder piston is hard to pull. This job is a disagreeable one, especially when the work has to be done under a locomotive in order to renew the clutch-cylinder gasket. At one enginehouse where considerable booster work is performed, different styles of piston pullers have been tried, but the one described in the following paragraphs has proved to be the most satisfactory.

A little preliminary work is required on each clutch cylinder, but when this has been done once, the subsequent savings more than pay for the first expense. The preliminary work required is to cut 12 threads to the inch (U. S. standard) in the counterbore at the top of the clutch cylinder piston. This can be done when the clutch cylinder is taken apart in the enginehouse or during repairs in the erecting shop. A short steel puller, 2 in. long, can then be made with an outside thread cut on one end to fit the thread in the piston counterbore, and the opposite end can be turned down to a diameter of 1¼ in. Next, drill a hole through the center of the puller and tap it out with a 3¾-in. U. S. standard tap, but before tapping, counterbore the drilled hole from the large end of the puller to a diameter of ⅞ in. and 1 in. deep. After this, make a steel set screw, 2½ in. long, having a ¾ in. U. S. standard threads and a rounded end—this to be casehardened.

In the operation of pulling a piston, the puller is screwed into the top of the piston after the nut has been removed, and the set screw is screwed through the puller against the top of the clutch-cylinder stud.

Steel Frame Wagon for Locomotive Tires

A STEEL frame on wheels has been made for carrying locomotive tires and other heavy parts about the Denver shops of the Colorado & Southern. The upright section is made of 1-in. by 4-in. steel, bent in an elongated U-shape, and mounted on two welded wheels. The frame is 7 ft. high and has an eyebolt through the top of the U for a chain. An 8-ft. section

A well-balanced wagon for handling locomotive tires

of heavy material with a hook at the front end passes over the top of this frame. The rear end of this section is forged round and is supported by a third wheel which is pivoted on the end of a 1-in. rod which, with a light strap, holds the long handle about waist high.

The entire frame is securely braced by three pairs of ½-in. by 2-in. straps bolted or welded to the frame. When in motion the front pair of straps is swung forward and across the notched ends of it and fit over a short bolt located just back of the hook. This arrangement helps to prevent lateral motion of the frame.

To load a tire, it is straddled with the wagon and the handle is raised until the chain can be looped around the tire. When the third wheel is borne down to the ground, the load is balanced and ready to be moved. A chain is used around the end hook to help steady the tire or for handling other material.

The Reader's Page

Have You a Question? Ask it
Have You an Opinion? Express it

A Foreman Should Attend to His Own Knitting

PITTSBURGH, PA.

TO THE EDITOR:

The letter to the editor, which appeared on the Readers' Page of the September issue of the *Railway Mechanical Engineer,* under the heading of "Who can settle this argument?" is interesting only in that it shows up a lack of training of railroad supervisory foremen.

As this is an age of specialization, the most valuable man to his employer is the one who confines his thoughts and energies to his own specific job. Even Jack Rennie, who is of this type of foreman, will find that his department will never be 100 per cent. He will be a superman if he can keep ahead, or even in line with, all the rapid improvements and developments of this age. On his ability to handle his own department successfully, the whole shop organization depends.

The shop superintendent could hardly expect to get maximum output if all his foremen were of Bill Kempt's type, who is sacrificing his own department to derive a personal gain by acquiring a knowledge of the shop methods in general.

Railroads, along with other industries, in the past few years by the use of specialized machinery, have revolutionized the repairing of locomotives and cars. The old universal machine is on the scrap heap. Side and main rods are no longer bored on a drill press.

If we are agreed that specialized machinery pays, is it not feasible to apply the same methods to shop departments? Bill Kempt's title is air brake foreman. He is a specialist on air brakes and, unlike the machine, he should become more efficient in his line each succeeding day.

The efficiency of a wheel lathe would be jeopardized by speeding up to turn a piston rod, so why is Bill Kempt not jeopardizing his position as a specialized foreman by going into other fields? If a general foreman is wanted, would it not be more economical to train one or two men for this position instead of allowing all the departmental foremen to fit themselves for positions of which there are not enough to go around?

I fail to see that Bill's knowledge of other departments makes him more valuable to his company. Although he might be able to supervise the blacksmith shop, this overlapping does not put any dividends in the pockets of the shareholders when another specialist is being paid for that job.

When the opportunity for advancement arrives Jack Rennie who, by confining his energies to his own department, has made it beyond criticism, will not be overlooked even if Bill Kempt has a fairly comprehensive knowledge of other departments. As to the possibility of college trained men being brought in to fill these positions, Bill Kempt's type will bring them. No one ever heard of a college man, trained as a mechanical engineer, taking the place of a district attorney and if these men are trained for specific jobs in railroad shops and by this training are able to increase the output or decrease the costs, there is a place for them in the shop.

P. I. H.

No Friend of the Slotter

DETROIT, MICH.

TO THE EDITOR:

On page 655 of the November, 1928, issue, F. Rattek writes "In Defense of the Slotter."

Ever since the writer became a cub machinist he has thought the slotter about the most inefficient and unsatisfactory of all the metal-cutting tools he was ever called upon to operate and, if ever it was at all possible to do the job on any other machine, he has always endeavored to do so.

This was before milling machines, both vertical and horizontal, were developed to their present state, and also before shapers, both ordinary and draw cut, had been brought to their present highly-efficient state.

While he does not expect everyone to agree with him in this, he thinks that about the only job for which a slotter now has any use in a modern railway shop is in cutting keyways in driving wheels and similar work.

He can well recall seeing fork ends of side rods slotted out taking four to six hours, and a 2-in. hole, necessarily drilled first, adding another half hour, that are now being machined on a milling machine in less than one hour, with no previous drilling necessary. Slotting around the ends of a pair of side rods, taking a whole day, can be done in a vertical milling machine in less than one third the time. Frame binders, when slotted, require cuts to relieve the spring of the tool. They can be done on a good shaper in half the time. Main rod brasses, when slotted on all four sides to fit the straps, take one and one half hours per pair. When machined on a planer, set up in a row, they require less than one hour per pair.

Locomotive main frames slotted for shoe and wedge fits, require extra cuts on account of the spring of the tool. They can be machined on a draw cut planer in at least 30 per cent less time than required for slotting. Driving boxes and crown brasses take almost twice as long to machine on a slotter, even with a competent operator. The same man can cut the time on either job, if performed on a special shaper, at least 40 per cent. Large and small crosshead keyways, slotted to size, after first having a series of holes drilled, take four times as long to slot alone, without taking into account the drilling time, as is required to mill them complete after first drilling for the milling cutter to pass through. The same thing may be said of the piston-rod crosshead key fit and so on all through the list of what some consider regular slotter work.

This subject is worthy of discussion and I should like to have the writer of the article mentioned give a list of just what work he considers can be more economically performed on a slotter than on either the miller or the shaper.

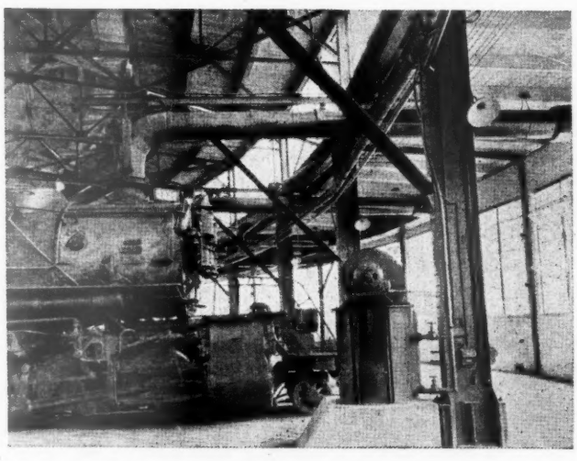
"PROGRESS"

Induced Draft System for Enginehouses

ONE of the features included in the Norfolk & Western enginehouse at Williamson, W. Va., is an induced-draft smoke-exhaust system designed by the Bayley Blower Company, 750 Greenbush street, Milwaukee, Wis. In this system, each stall is fitted with a long, two-section, overhead exhaust duct, about 2 ft. in diameter, which extends in a horizontal plane directly over the pit track from a collecting duct around the rear of the house. The forward section of this exhaust duct is supported over the track by a horizontal beam and telescopes within the rear section for a distance of 15 ft.

As arranged throughout the house, the exhaust ducts of four adjacent stalls are operated as a unit and each unit is equipped with an exhaust fan, an arrangement which makes it necessary to operate the exhaust system only on those tracks which are occupied.

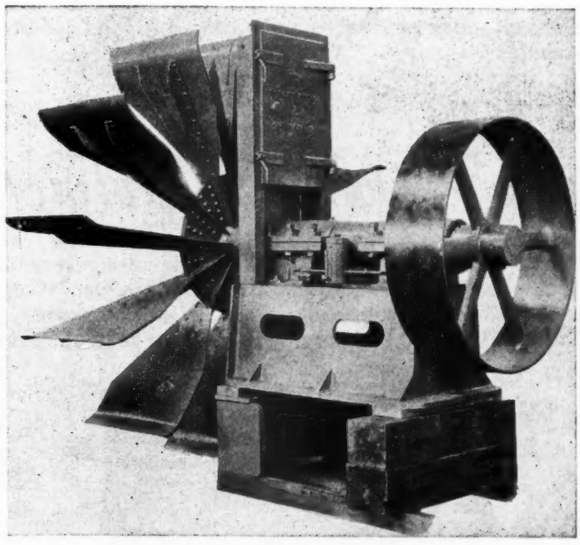
The system eliminates steam blowers. Its principal



A locomotive in place with the slip-joint connection to the jack to allow for engine movement

parts are the Bayley special exhaust fan, a corrosion-resisting duct system and smoke jacks or branch smoke connections to collect the smoke from the locomotive stacks. Jacks are provided with swivel and telescopic joints, so that the locomotive can go forward one complete revolution of the drivers, without breaking the engagement. The housing of the fan, suitable for mounting in the roof trusses, is made of cast iron and fitted with an air-tight inspection door. The fans used to connect to the underground duct systems have cast iron scrolls and brick sides.

The journal boxes are water-cooled and of the ring-oiling type, self-alining and lined with babbitt metal. All parts are firmly held in position by bolts. The lower half of the box is in one piece, which forms an



Wheel, bearing and sub-base assembly for use with underground smoke ducts

oil reservoir from which the oil is continuously fed to the journal by the oil ring.

The blast wheels are of the built-up type. The center disc is of cast steel and the floats of cast bronze riveted to cast steel arms with bronze rivets. This construction gives the wheel great strength, adds materially to the life of the fan, and makes a wheel easy to repair.

The shafts are of hammered steel, accurately turned to size, and of large diameter to withstand the heavy stress caused by the weight of the turning wheel. The motors for driving the fans are of a two-speed design to

allow of variation in the quantity of gases discharged by the fan, according to the varying conditions under which the fan must work in service.

Where overhead ducts are used they are made of heavy cast iron. Where underground ducts are used they are made of concrete and tile—the penstocks connecting to the ducts are of heavy iron and arranged for easy adjustment to the locomotive stacks.

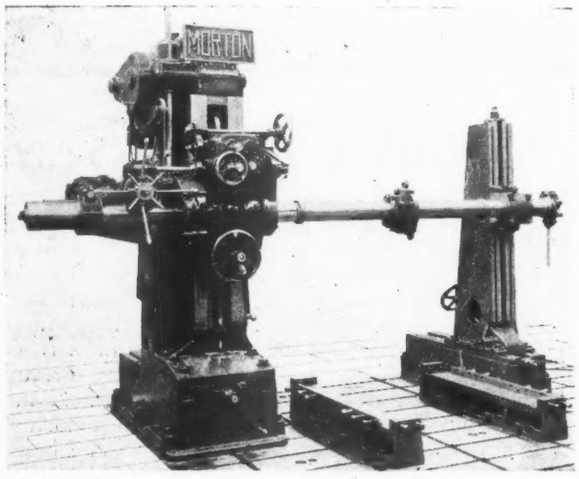
With the Bayley system, it is claimed that engine gases are practically excluded from the house, firing-up operations are greatly expedited, and in addition, a means is provided for creating an induced draft in the fireboxes of hot engines, thereby making it possible for firebox inspection to take place in a short time after the fire has been drawn. All of these features expedite the movements through the enginehouse.

Morton Piston-valve Boring Machine

THE Morton Manufacturing Company, Muskegon Heights, Mich., has placed on the market a horizontal piston-valve boring machine which has an arbor 5 in. in diameter. Vertical and horizontal adjustments are made by hand. The arbor is bored for a No. 7 Morse taper. The machine has an automatic feed of 14 in. horizontally and six feed changes. Scales are provided for setting on the columns and bed for horizontal and vertical movements.

A special outer bearing is provided for the 5-in. boring bar. It has 44 in. of vertical adjustment and 24 in. of horizontal adjustment. Two special parallels are provided for setting and leveling the cylinder for boring operations. Set screws for raising and lowering, and moving laterally are provided and ample provisions are made for binding down the cylinder.

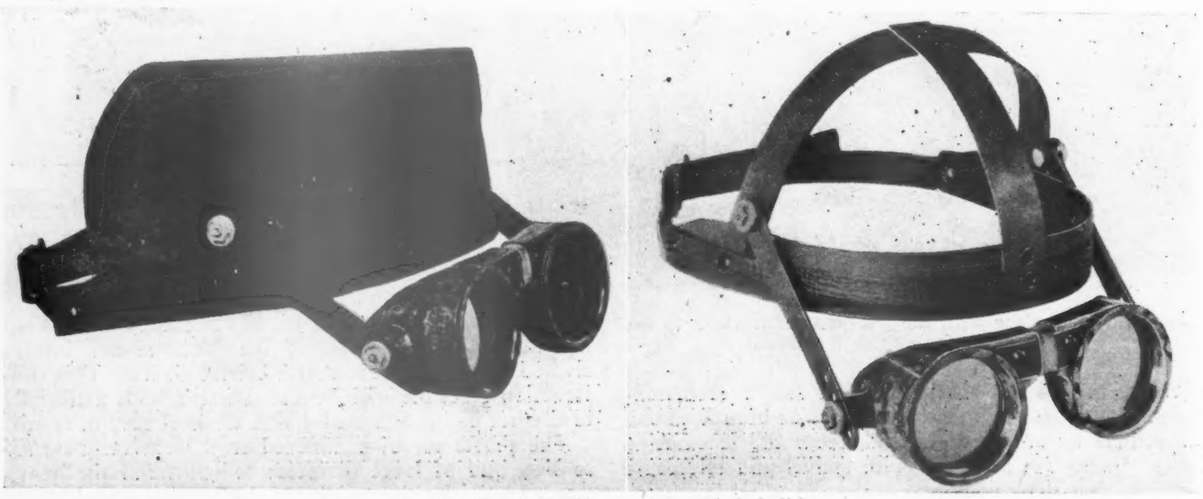
The machine is driven by a 7½-hp. direct-connected motor. The power is transmitted through a silent chain, running in oil, to the gear box and friction clutch. Control levers are conveniently located for the operator and the unit can be started and stopped independently of the motor.



The Morton locomotive horizontal piston-valve boring machine

Oxweld Helmet Type of Goggles

ACCESSORIES for welding and cutting recently added to the line of the Oxweld Acetylene Company, 30 East Forty-second Street, New York, are the Oxweld cap and skeleton type helmet goggles. The No. 9 cap type goggles consist essentially of a strong fibre cap to which a pair of goggles is attached by fibre links. The goggles can be readily raised over the forehead or lowered over the eyes with one hand. The



The Oxweld cap and skeleton types of helmet goggles

bridge is adjustable and is covered with rubber insulation. Replaceable lenses, in the same size and colors as are supplied in Oxweld No. 6 goggles, are used, the colored lenses being protected by cover lenses of clear glass. The No. 10 skeleton type goggles are the same, except that the goggles are attached to a lattice skeleton cap. Both styles are provided with leather straps at the rear for head-size adjustment.

The cap and skeleton type goggles furnish adequate protection and greater convenience for the welder.

A Hydraulic-Feed Surface Grinder

A NO. 5 surface grinder, equipped with an oilgear hydraulic feed, has recently been added to the line of grinding machines built by the Gallmeyer & Livingston Company, 344 Straight avenue, S.W., Grand Rapids, Mich. Except for its larger size, this machine is similar to the No. 4 hydraulic surface grinder built by the same company. With the oilgear mechanism, an infinite number of feeds, ranging from almost nothing to 55 ft. per min., are obtained by merely turning a handle on the front of the base.

Grand Rapids surface grinder provided with an oilgear feed

The oilgear mechanism is connected to a crossfeed mechanism under the saddle, the arrangement being such that with each reversal of the reciprocating table, the cross-feed mechanism is actuated. The cross-feed mechanism may be set to operate at each end of the reciprocating table stroke or at one end only, and to feed either in or out. The amount of cross feed for each reciprocation of the table is also adjustable.

Another important feature of the machine is the method of raising and lowering the wheel-head. By turning a large handwheel, the head can be rapidly raised or lowered a considerable distance. This gives a direct action through worm-gearing to the elevating screw. The handwheel is graduated to .00025 in., and has a removable pointer which can be set to enable readings to be conveniently made.

However, when it is desired to obtain very accurate readings for grinding to close limits, the smaller handwheel or knurled hand-knob in the center of the large hand-wheel is turned. This gives a back-gear action to the elevating mechanism. The disk in the center of the handwheel has a graduated dial-ring which can be easily set to zero in relation to the pointer mounted on the spoke of the large handwheel. Both the inner and outer wheels turn, but the graduations on the inner wheel are arranged to give a vernier effect, in combination with the moving pointer. By this means, it is easy to obtain adjustment readings to .0001 in. from graduations over ⅛ in. apart. One-thousandth of an inch is represented by spaces on the graduated dial almost 1½ in long.

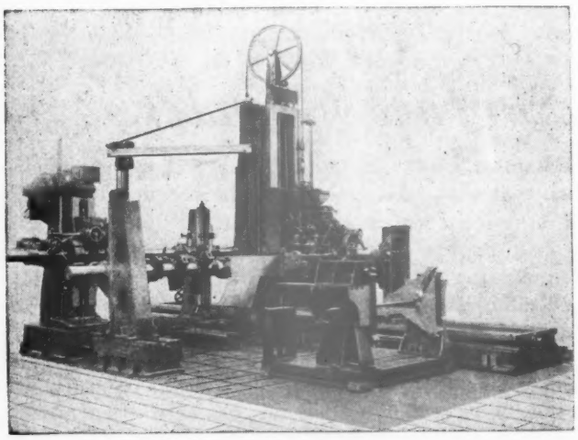
Some of the important specifications of this machine are as follows: Longitudinal and transverse automatic table travel, 38 and 12 in., respectively; working surface of the table, 10 in. by 36 in.; vertical movement of the wheel-head, 13¾ in.; maximum distance from the wheel to the table under 10-in. and 7-in. wheels, 12¼ in. and 13¾ in., respectively. The weight of a motor-driven dry-grinding machine, without accessories, is 4,250 lb.

Morton Cylinder Planing and Boring Machine

THE 72-in. stroke traveling-head cylinder planing and boring machine, shown in the illustration, has been designed by the Morton Manufacturing Company, Muskegon Heights, Mich., to machine locomotive cylinders. The cylinder is first placed in the floor chucks for boring operations. The piston-valve chamber is bored and faced by the piston-valve boring unit; the main barrel is bored and faced at the same time by the traveling-head unit. When the boring operations are completed, the cylinder is placed in the special chucks for the planing and milling operations. The traveling-head unit moves over to the work and finishes all planing and milling operations. In the meantime, a new cylinder is placed in the floor chucks and made ready for the boring operations. The traveling-head unit is then moved back to the boring position and in a few minutes is at work boring the main barrel.

In general construction, this machine is similar to other Morton traveling head planers. When operating as a planer, it feeds either horizontally on the bed or vertically on the column. It is provided with automatic ram feeds for boring and milling. The feed-gear box

has eight changes in each direction, giving a range suitable for both boring and milling. All boring and milling feeds are started and stopped by one lever. Rapid power traverses are provided for all of the motions.



A front left view of the Morton 72-in. stroke traveling-head cylinder planing and boring machine

The floor plate is made in two sections and measures approximately 15 ft. by 20 ft. The cylinder chucks are of the three-jaw universal type, the jaws expanding into the counterbore of the cylinders. The main barrel boring outfit consists of a boring bar, cutter heads and an outer support. The boring bar is 5 in. in diameter The port-milling attachment may be quickly attached to the square section of the ram without removing the standard planer head. A 10-in. face mill is part of the regular equipment for milling operations.

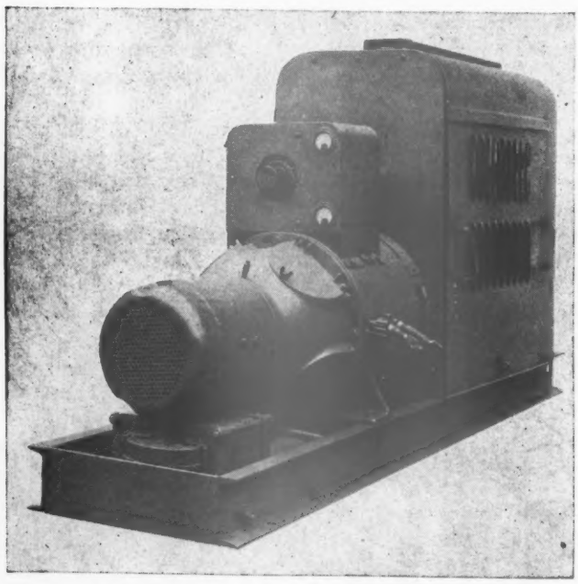
A one-piece work table is usually included as part of the equipment. It is 30 in. high, 36 in. wide and 8 ft. long. This is especially useful for holding frames and other large work for the various machining operations which can be performed on this machine. The push-and-pull cutter head is threaded to fit either the planer head or grip ring. The special extension head is especially designed for planing the upper frame fit of piston-valve cylinders.

A 10-hp. reversing-type motor is used to operate the machine. The power is transmitted through mitre gearing and a vertical shaft to the operating mechanism contained in the vertically-moving apron. The reciprocating motion of the ram is controlled entirely by the reversing motor drive.

The machine has a stroke of 72-in., a vertical feed of 96 in. and a horizontal feed of 18 ft. A longer bed or column can be furnished when desired, giving additional horizontal or vertical feed. Two traveling-head units can also be placed on one bed.

Gas-Engine-Driven Arc Welding Set

A *SELF*-contained, gas-engine-driven arc-welding set has been recently developed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. It has been designed particularly for pipe-



The Westinghouse gas-engine-driven arc-welding set

line construction, structural steel work, railroad construction and general welding service in isolated places not having electric power available.

The machine is compact and rugged in design, requiring a minimum amount of floor space and capable of withstanding strenuous use. Its overall dimensions are: Length, 73 in., width, 25 in., and height, 46½ in. The approximate net weight ready for operation is 1,700 lb.

The complete set consists of a model P-20 Continental gas engine directly connected to a new type Westinghouse 200-amp. arc-welding generator, with a direct-connected exciter overhung from the generator bracket. To provide greater compactness, the generator has a special bracket which fits into the engine housing. Protective covers over the generator, commutator and engine head make the complete equipment weather proof without the use of a canopy. The engine and generator, complete with all controls, are mounted on an all-welded channel base. The equipment may be made suitable for either stationary or portable use in the repair shop.

The model P-20 is a four-cylinder Continental engine, rated at 24 b.hp. at 1,450 r.p.m., the generator speed. It will operate under a normal load for eight hours on 10 gallons of gasoline. A Zenith carburetor with a friction-type choke is operated by a positive centrifugal-type governor. The lubricating system is pressure-fed by a gear-driven pump. A centrifugal water pump and liberal radiator capacity provides an efficient cooling system which is necessary for severe usage in repair work.

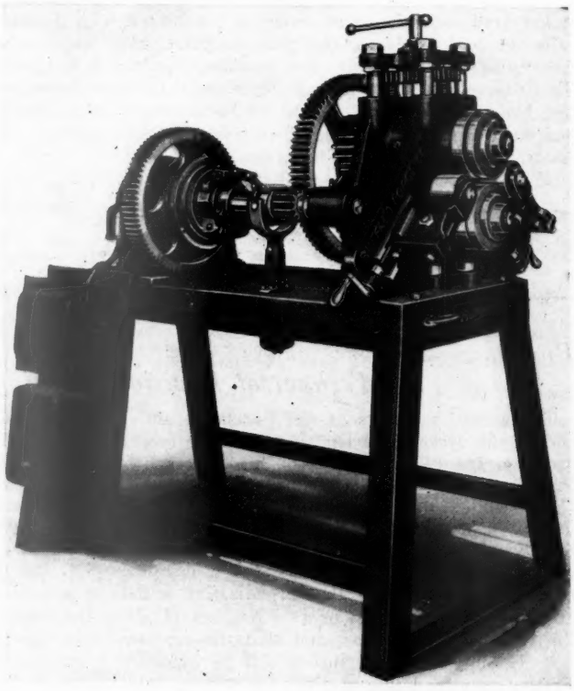
The generator is a special type S.K., constant current, differentially compound-wound machine. It is rated for 200 amp. one hour, 50 deg. C. rise, on a resistance load at 25 volts, in accordance with N.E.M.A. standard practice. The field rheostat, ammeter and voltmeter are all mounted in a control cabinet located on top of the generator frame. The welding range is from 60 to 300 amp.

Figured Graduations Placed on Steel Rules

FIGURED graduations are now placed on both corners of one side of the 6-in. flexible steel rule, No. 306, manufactured by the Brown & Sharpe Manufacturing Company, Providence, R. I. This feature enables readings to be made quickly and accurately. Thirty-seconds of an inch are numbered every fourth graduation and the sixty-fourths every eighth graduation.

Buffalo Vertical-Type Bending Rolls

A NO. 0 bending roll has recently been added to the line of bending machines built by the Buffalo Forge Company, 144 Mortimer street, Buffalo, N. Y. Although the smallest of the line, this bending roll has the same operating characteristics as the larger machines. There is an all-steel one-piece frame, supported by legs, and a table of welded steel. A triple set of hand-operated cranks facilitates changing the rolls. The working parts are lubricated by the Zerk system. On the motor-driven machine, the 2-hp. motor is equipped with a switch box and push-button control. The machine can also be arranged for belt drive.

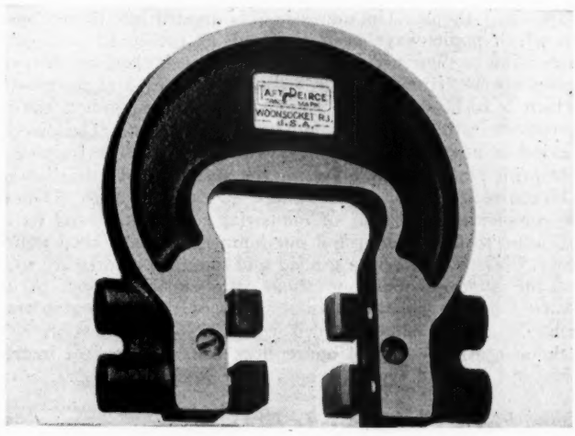


Buffalo motor-driven bending rolls

The machine has a capacity for bending, with the leg outward, angle-irons as large as 1¼ in. by 3/16 in. to a minimum diameter of 7 in., and as small as ½ in. by ⅛ in. to a minimum diameter of 6 in. Flat bars up to 1½ in. by ⅜ in. can be bent on edge to a minimum diameter of 7 in., while flat bars from 2 in. by ⅜ in. to 2½ in. by ½ in., can be bent on the flat to a minimum diameter of 6 in. Round bars ⅞ in. in diameter and 11/16-in. square bars can be bent to a minimum diameter of 6 in. This equipment weighs approximately 750 lb.

Snap-Gage Principle Applied to Thread Gages

AN entirely different tool for external thread gaging, which uses the snap-gage principle, has been placed on the market by the Taft-Peirce Manufacturing Company, Woonsocket, R. I. The gage has much the appearance of the snap gage, but is provided with four hardened tool-steel anvils, paired for "go" and "not go" gaging, and accurately and easily adjustable.



The Taft-Peirce thread gage which gages a thread with a thread

The gaging members are true thread forms ground in the faces of the anvils and correct as to all thread elements. No annular rolls or straight grooves are employed. The adjustment is simple and the anvils may be set to any pitch diameter within their range by the use of a reference thread plug gage or by the use of wires and measuring blocks.

At present the gage is made in eight sizes from ¼ in. to 4 in., and threaded anvils can be furnished for any pitch and percentage of thread engagement desired.

THE AIR MAIL is a fast method of transmitting papers which cannot be entrusted to the telegraph, but not always quite fast enough, and a saving of six hours in workshop time and 24 hours or more in delivery time was reported recently by Joseph T. Ryerson & Son, by using the telegraph for sending an order, including a blue brint from St. Louis to Chicago. This made a material saving of time in the delivery of ten tons of steel.

An order from Tulsa, Okla., for steel bars, ties and wire to be delivered in La Rose, Ill., was sent from Tulsa to St. Louis by fast mail; was found at St. Louis to be of a character necessary to repeat to Chicago, and was then telephotographed, with the drawing, to the latter city.

Copies were sent to the shop with orders to pay bonuses for both shearing and banding, and by doubling the crews of workmen, the job was finished in one hour and twenty-five minutes. The traffic department put in a special order for a car, and by the cooperation of the Pennsylvania and the Santa Fe, had the shipment started from Chicago that night, and it was delivered in La Rose, 116 miles from Chicago, at 4:20 the next morning.

News of the Month

Burlington Shop Schools

The Chicago, Burlington & Quincy, following the success of its schools for shop apprentices at West Burlington, Iowa, and Havelock, Neb., has established a third school at its Aurora (Ill.) shops. The new school is divided into three classes, to which pupils have been assigned, as nearly as practicable, according to their previous education. Each class has two sessions a week, from 7 a.m. to 9 a.m. After the first six months, which is to be devoted to foundation work in groups, the apprentices will receive individual instruction. The weekly period is now divided as follows: One hour for training in blueprint reading; one hour for the sketching of miscellaneous objects such as castings, forgings, etc., classed with reference to complexity; one hour of industrial mathematics, and its application to shop work; and one hour of practical shop sketching. Classroom work is graded and monthly reports are made to the superintendent of shops, the superintendent of the Aurora public schools, the supervisor of the Burlington trade schools, and the state supervisor of industrial education. The school is attended by 31 apprentices who receive free instruction and are paid regular wages while attending classes.

Mechanically-Operated Firedoors Recommended

The Interstate Commerce Commission on December 6 made public a proposed report by Special Examiner John L. Rogers on the complaints filed by the Brotherhood of Locomotive Engineers, the Brotherhood of Locomotive Firemen and Engineman and the Public Utilities Commission of Ohio, recommending that the commission find that "the safety of employees and travelers upon railroads requires that steam locomotives, except locomotives using oil fuel, have a mechanically-operated firedoor, so constructed and maintained that it may be operated by pressure of the foot on a pedal, or other suitable appliance, located on the floor or deck of cab or tender and a suitable distance from the firedoor, so that it may be conveniently operated by the person firing the locomotive." Appropriate additions to the rules for the inspection and testing of locomotives and tenders are recommended, to be made effective immediately on new locomotives and as to locomotives in service when they receive Class 4 or heavier repairs, with a provision that all locomotives shall be equipped as required by not later than January 1, 1931.

The legislatures of a number of states had passed laws requiring mechanically-operated firedoors but the Supreme Court held that state legislation on the subject had been precluded because the federal boiler inspection act was intended to occupy the field; and therefore the complaints were filed with the commission. The railroads did not question the power of the commission to require the device but those who opposed the issuance of an order urged that the facts are not sufficient to justify the exercise of the power; that the hand-operated and the mechanically operated firedoors are about equally safe and that there are certain substantial objections to the mechanically-operated door from the standpoint of operation which render this type of door undesirable. The cost of applying the mechanically operated door was stated as approximately $125 per locomotive as against about $15 for the hand-operated door; and the American Railway Association, in its answer on behalf of the major railroads, took the position that expenditures for mechanically-operated doors are less urgent than the needs for other safety measures.

As to this the examiner's report says that the five major carriers who have done less in applying mechanically-operated doors than others and on which most of the locomotives still have hand-operated doors, are among the most prosperous roads in the United States; also that the saving in fuel to be expected from the use of the mechanical doors should return the cost in less than a year.

The chief inspector of locomotives of the commission has frequently recommended such a requirement and the report states that such doors have been applied voluntarily by a majority of the carriers. A questionnaire sent to all Class I roads showed that of 59,894 locomotives, 7,198 stoker-fired locomotives and 25,468 hand-fired locomotives are equipped with mechanically-operated firedoors, while 6,998 burn oil as fuel. In commenting on the summary of the replies the report says that 61 per cent of all hand-fired locomotives and 70 per cent of the stoker-fired locomotives in service are equipped with mechanically-operated firedoors, and that the principal defense in the proceedings was made by the Chicago, Burlington & Quincy, the Reading, the Pennsylvania, the Central of New Jersey and the Union Pacific, which had 11,200 locomotives in service and only 13 per cent equipped with mechanically-operated firedoors.

Clubs and Associations

Purchases & Stores and Mechanical Division Meetings

The annual meetings of the Purchases and Stores Division and of the Mechanical Division of the American Railway Association for 1929 will both be held on the west coast. The Purchases and Stores Division will meet at San Francisco, Cal., while the meeting of the Mechanical Division will be held in Los Angeles, Cal., June 25-28. The Railway Supply Manufacturers' Association will not exhibit in connection with these meetings, but it is understood that the executive committee of that organization will hold a meeting at either San Francisco or Los Angeles at about the time of the railroad conventions, and that the representatives of the railway supply manufacturers will be extended a cordial invitation to attend the meetings of railway associations.

Mechanical Engineers Annual Meeting

The annual meeting of the American Society of Mechanical Engineers, which was held in the Engineering Societies building, 29 West Thirty-ninth Street, New York, December 3 to 7, 1928, inclusive, drew the largest attendance for this event in the history of the society. The total registration for the week was 2,525, which exceeds the registration figure of 2,335 for 1927 by 190. The attendance of mechanical engineers employed in the railroad and railway supply industries also broke all previous records. Both the morning and afternoon sessions of the Railroad Division were well attended, nearly 100 registering at the morning session, Wednesday, December 5, and considerably over that number at the afternoon session.

The Seventh National Exposition of Power and Mechanical Engineering was also held during the same week at the Grand Central Palace, New York. The exposition this year had a total of 644 exhibits, of which 300 were exhibits of machinery

or equipment for the generation, distribution, or utilization of power; 183 related to heating, ventilation or refrigeration; 28 showed instruments for the indication or control of steam pressure, temperature, time or speed; 17 showed safety appliances, and 112 exhibited machine tools or shop equipment.

This year for the first time the Executive Committee of the Railroad Division made a careful study of the entire program of the annual meeting and developed a program of technical papers that it considered to be of interest to railroad men. The consolidated railroad program consisted of 33 papers, only four of which were presented by the Railroad Division itself, the others being presented by other professional divisions of the society, such as the Machine Shop Practice, the Materials Handling, Management, Oil and Gas Power, etc.

A short business session of the Railroad Division was held at the close of the technical sessions on Wednesday afternoon, December 5. It was decided to appoint a general committee of 15 members, in addition to the Executive Committee of five members, which would elect each year the new member of the Executive Committee, subject to the approval of the president of the society. The General Committee will assist in the supervision of the activities of the division. It was also decided to increase the Survey Committee of the division to 10 members, whose function would be to report on the various research and standardization projects of the society and to represent the division in the conduct of any of this work, where considered necessary.

The following were appointed by the president of the society to serve on the Executive Committee, Railroad Division, for 1929: R. S. McConnell, chief consulting engineer, Baldwin Locomotive Works, Philadelphia, Pa. (chairman); A. F. Stuebing, chief engineer, Bradford Corporation, New York; Eliot Sumner, assistant to general superintendent of motive power, Pennsylvania, Philadelphia, Pa.; A. G. Trumbull, chief mechanical engineer, Erie, New York; Joseph B. Ennis, vice-president in charge of engineering, American Locomotive Company, New York, and Marion B. Richardson, associate editor, *Railway Mechanical Engineer,* New York (secretary).

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad Clubs.

AIR-BRAKE ASSOCIATION.—T. L. Burton, 165 Broadway, New York. Next meeting, April 30-May 3, 1929, at Stevens Hotel, Chicago.

AMERICAN RAILWAY ASSOCIATION DIVISION V—MECHANICAL.—V. R. Hawthorne, 431 South Dearborn St., Chicago. Annual meeting June, 1929, at Los Angeles, Cal.

DIVISION V—EQUIPMENT PAINTING SECTION.—V. R. Hawthorne Chicago. Next meeting, September, 1929.

DIVISION VI—PURCHASES AND STORES.—W. J. Farrell, 30 Vesey St., New York.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—G. G. Macina, 11402 Calumet avenue, Chicago. Next meeting, September 11-14, 1929, Hotel Sherman, Chicago.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. Thirty-ninth St., New York. Railroad Division, Marion B. Richardson, associate editor, *Railway Mechanical Engineer,* 30 Church St., New York.

AMERICAN SOCIETY FOR STEEL TREATING.—W. H. Eiseman, 7016 Euclid Ave., Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS.—C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

AMERICAN WELDING SOCIETY.—Miss M. M. Kelly, 29 West Thirty-ninth street, New York.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—Joseph A. Andrucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago, Ill.

CANADIAN RAILWAY CLUB.—C. R. Crook, 129 Charon St., Montreal, Que. Regular meetings, second Tuesday in each month, except June, July and August, at Windsor Hotel, Montreal, Que. Next meeting January 14, 8:15 p.m. Paper on The Relationship of the Steamship to Railroad Transportation will be read by A. A. Gardiner, general passenger agent, Canadian National, Montreal.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—G. K. Oliver, Chicago & Alton, Chicago, Ill. Regular meeting second Monday in each month, except June, July and August, Great Northern Hotel, Chicago. Next meeting January 14, 8 p.m. Discussion of the A.R.A. Rules.

CAR FOREMEN'S ASSOCIATION OF ST. LOUIS.—A. J. Walsh, 5874 Plymouth Apt. 18, St. Louis, Mo. Regular meeting first Tuesday in each month, except June, July and August, at Broadview Hotel, East St. Louis, Ill.

CAR FOREMEN'S CLUB OF LOS ANGELES.—J. W. Krause, 514 East Eighth St., Los Angeles, Cal. Meeting second Friday of each month in the Pacific Electric Club building, Los Angeles, Cal.

CENTRAL RAILWAY CLUB.—H. D. Vought, 26 Cortlandt St., New York. Regular meetings second Tuesday each month, except June, July and August, at Hotel Statler, Buffalo. Next meeting Thursday, January 10, at 7 p.m. Reception. Addresses by Samuel O. Dunn, editor, Railway Age, and Rev. G. A. Leichliter, Prospect avenue Baptist Church, Buffalo. Entertainment. Election of officers will take place at a meeting of the members at 2 p.m. in the afternoon.

CHIEF INTERCHANGE CAR INSPECTORS AND CAR FOREMEN'S ASSOCIATION.—See Master Car Builders' and Supervisors Assn.

CINCINNATI RAILWAY CLUB.—D. R. Boyd, 3328 Beekman St., Cincinnati. Regular meeting second Tuesday, February, May, September and November.

CLEVELAND RAILWAY CLUB.—F. L. Frericks, 14416 Adler Ave., Cleveland, Ohio. Meeting first Monday each month, except July, August and September, at Hotel Hollenden, East Sixth and Superior Ave.

INTERNATIONAL RAILROAD MASTER BLACKSMITHS' ASSOCIATION.—W. J. Mayer, Michigan Central, 2347 Clark Ave., Detroit, Mich. Next meeting, August 20-22, 1929, Fort Shelby Hotel, Detroit.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—L. G. Plant, Railway Exchange, 80 E. Jackson Boulevard, Chicago. 1929 Annual meeting Hotel Sherman, Chicago, May 7-10, Inclusive.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 1061 W. Wabash Ave., Winona, Minn.

LOUISIANA CAR DEPARTMENT ASSOCIATION.—L. Brownlee, 3212 Delachaise street, New Orleans, La. Meetings third Thursday in each month.

MASTER BOILERMAKERS' ASSOCIATION.—Harry D. Vought, 26 Cortlandt St., New York. Annual meeting May 21-24, 1929, Hotel Biltmore, Atlanta, Ga.

MASTER CAR BUILDERS' AND SUPERVISORS' ASSOCIATION.—A. S. Sternberg, master car builder, Belt Railway of Chicago, Chicago.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic Ave., Boston, Mass. Regular meeting second Tuesday in each month, excepting June, July, August and September, Copley-Plaza Hotel, Boston. Next meeting January 8. Paper on Some Aspects of Modern Packing and Container Practices will be presented by Edward Dahill, chief engineer, Freight Container Bureau, American Railway Association.

NEW YORK RAILROAD CLUB.—H. D. Vought, 26 Cortlandt St., New York. Meetings third Friday in each month, except June, July and August, at 29 West Thirty-ninth St., New York. Next meeting January 18. Paper on Oxygen, The Wonder Worker will be presented by A. G. Harcke.

PACIFIC RAILWAY CLUB.—W. S. Wollner, 64 Pine St., San Francisco, Cal. Regular meetings, second Tuesday of each month in San Francisco and Oakland, Cal., alternately.

RAILWAY CAR DEPARTMENT OFFICERS' ASSOCIATION.—See Master Car Builders' and Supervisors' Association.

RAILWAY CLUB OF GREENVILLE.—Paul A. Minnis, Bessemer & Lake Erie, Greenville, Pa. Meeting third Thursday of each month, except June, July and August. Next meeting January 15 at 6:15 p.m. at Reformed Church, Greenville. Paper on The Porter Cut Off will be read by H. T. Porter, Chief Engineer, B. & L. E.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, 515 Grandview Ave., Pittsburgh, Pa. Regular meeting fourth Thursday in month, except June, July and August. Fort Pitt Hotel, Pittsburgh, Pa.

ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, M. P. O. Drawer 24, St. Louis, Mo. Regular meetings, second Friday in each month, except June, July and August.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.—A. T. Miller, P. O. Box 1205, Atlanta, Ga. Regular meetings third Thursday in January, March, May, July, September and November. Annual meeting third Thursday in November, Ansley Hotel, Atlanta, Ga.

SOUTHWEST MASTER CAR BUILDERS' AND SUPERVISORS' ASSOCIATION.—See Master Car Builders' and Supervisors' Association.

TRAVELING ENGINEER'S ASSOCIATION.—W. O. Thompson, 1177 East Ninety-eighth St., Cleveland, Ohio.—Annual meeting Hotel Sherman.

WESTERN RAILWAY CLUB.—W. J. Dickinson, 189 West Madison St., Chicago. Regular meetings, third Monday in each month, except June, July and August.

Supply Trade Notes

W. H. ALLEN has been appointed eastern sales agent for the Sellers Manufacturing Company, Chicago, with headquarters at 50 Church Street, New York, to succeed E. W. VanHouten, resigned.

W. J. HOLTMEIER has been appointed to take charge of the sales and advertising of the Hill-Curtis Company, Kalamazoo, Mich., manufacturers of polishing and grinding machinery. Mr. Holtmeier had been associated with the Hisey-Wolf Machine Company for twelve years, during the past three years having served as general sales representative and advertising manager.

WALTER W. NOWAK, European manager of the Niles-Bement-Pond Company and the Pratt & Whitney Company, died in Paris on November 1. He had been with the affiliated companies since his graduation from Cornell University in 1905, representing them at first on the Pacific Coast and later in Chile, Argentine and Brazil. For the last ten years, he had been in entire charge of the European business of the companies, with headquarters in London and Paris.

LYON METAL PRODUCTS, INC., Aurora, Ill., has purchased the Durand Steel Locker Company, Chicago Heights, and the Lyon Metallic Manufacturing Company, Aurora. The officers of the new company are: President, F. S. Waters, formerly president of Lyon Metallic Manufacturing Company; chairman of the board, H. A. Gardner, formerly secretary of Durand Steel Locker Company; vice-president, Keith Spaulding, formerly president of the Durand Steel Locker Company; vice-president Walter N. Vance, formerly engineer and plant manager of the Durand Company; vice-president, C. E. Gerberich, formerly with the Lyon Metallic Manufacturing Company; secretary, B. L. Waters, formerly of the Lyon Metallic Manufacturing Company; assistant secretary Henry A. Struck, formerly manager

of sales of the Durand Company; treasurer, W. B. Brown, formerly with the Durand Company, and assistant treasurer, A. W. Lauder, formerly director of advertising for the Lyon Metallic Manufacturing Company.

J. HARVEY HART has been appointed general purchasing agent of the Baldwin Locomotive Works, with headquarters at Eddystone, Pa. Mr. Hart entered the service of the Baldwin Locomotive Works in February, 1893, and has been with the company continuously since then, with the exception of two years from November, 1893, to November, 1895. He was first employed in the storeroom, and was transferred to the receiving department in June, 1896, and from there to the purchasing department in June, 1905. He was appointed assistant purchasing agent on June 1, 1919, and served as purchasing agent since June, 1922.

T. P. O'BRIAN has again become associated with the O. M. Edwards Company, Syracuse, N. Y. He will have entire charge of the sales in the railroad traction and motor coach fields in the eastern and southern districts. Mr. O'Brian has opened a new office at 50 Church Street, New York City, and will be assisted by George G. Allison. Mr. O'Brian started his career in the railroad field in the service of the Pullman Company working in various capacities, finally having charge of the mechanical inspection in the Buffalo district, until 1910, when he left the Pullman Company to become associated with the O. M. Edwards Company and in 1916 he went with the Curtain Supply Company in its sales department having charge of the southern district. In 1922, Mr. O'Brian was made eastern sales manager of the Curtain Supply Company, remaining in that position until the company was merged with the Adams & Westlake Company in 1927, when he took charge of the combined eastern offices in New York City. Mr. Allison became associated with the Curtain Supply Company in the early part of 1919 and after three years service in the factory and general office, he became office manager. In 1922, M. Allison was transferred to the eastern sales office in New York City working under the direction of Mr. O'Brian. Mr. Allison will have charge of the southern district, with headquarters at 50 Church Street, New York City.

T. P. O'Brian

THE BUSINESS of the Niles Tool Works Company, formerly owned by the Niles-Bement-Pond Company, and the Hooven, Owens, Rentschler Company, both of Hamilton, Ohio, are now consolidated under the ownership of the General Machinery Corporation. The officers and directors of the corporation are: G. A. Rentschler, president; Gordon S. Rentschler; Edward A. Deeds; William B. Mayo, vice-president; A. A. Byerlein, vice-president; Curtis T. Ziegler, vice-president; Walter A. Rentschler, secretary and treasurer; Fred B. Rentschler; J. K. Cullen; G. H. Helvey; C. H. Helvey; Leonard S. Horner, and Sanford G. Etherington.

THE TIMKEN ROLLER BEARING COMPANY through a reorganization affecting its Pacific Coast territory, has established two new permanent offices, one in Los Angeles, Cal., and another in Seattle, Wash. The former will be in charge of Roy Cross, at 1361 South Figueroa Street, Los Angeles, and the latter in charge of Marshall Cooledge, at 321 South Pine Street, Seattle. G. C. McMullen remains as district manager at the company's San Francisco office.

THE PULLMAN CAR & MFG. CORPORATION has purchased the equipment of the Tennessee Coal, Iron & Railroad Company's car building plant at Birmingham, Ala. Arrangements are being made to procure a site in Birmingham and to enlarge and improve the capacity of that plant.

THE FOOTE BROS. GEAR & MACHINE COMPANY, Chicago, has purchased the Lyle Culvert & Road Equipment Company, the Stockland Road Machinery Company, the Northwestern Steel & Iron Corporation, all of Minneapolis, Minn., and the Bates Manufacturing Company, Joliet, Ill. The latter companies will be operated as divisions of the parent company.

W. M. GARRIGUES, assistant general manager of sales of the Central Alloy Steel Corporation, Massillon, Ohio, has been appointed general sales manager. M. H. Schmid, assistant sales manager of the alloy division has been made sales manager of the bar and billet division. J. S. Andrews, assistant district sales manager at Detroit, has been made assistant sales manager of the sheet and strip division at Massillon.

CHARLES M. MUCHNIC, vice-president of the American Locomotive Sales Corporation, at New York, who has resigned, was born on March 17, 1877, and graduated from the Drexel Institute of Arts and Sciences, Philadelphia, Pa., in June, 1896. The same year he was employed in designing locomotives at the Baldwin Locomotive Works and then, during 1897 and 1898, in designing locomotives at the Brooks Locomotive Works, which later became part of the American Locomotive Company. He was then, during 1899, in the designing department of the Cie. de Fives Lille, Fives Lille, France, engaged in designing locomotives embodying American features of construction, for service in China. From January, 1900, to the following July he was engaged in collaboration with Mr. DeGlehn of the Societe Alsacienne des Construction Mecaniques, at Mulhouse, Alsace, in the design of the first four-cylinder consolidation type of locomotive for service on the Midi Railway of France. He was then, until February, 1901, technical and sales representative of the Baldwin Locomotive Works in Europe, with headquarters in Paris, and was in charge of its exhibit at the Paris Exposition. He was next appointed mechanical engineer of the Wisconsin Central at Fond du lac, Wis. From February, 1902, to the following November he served as mechanical engineer of the Denver & Rio Grande at Denver, Colo., and then to 1905 was assistant to the vice-president in charge of sales of the American Locomotive Company. From 1905 to 1915 he was manager of the foreign department of the same company and since that time served as vice-president for the American Locomotive Sales Corporation.

Charles M. Muchnic

STRICKLAND L. KNEASS, a vice-president of William Sellers & Co., Inc., Philadelphia, Pa., died on November 24 at his home in Daylesford, Pa. Mr. Kneass served the Sellers Company continuously since September, 1880. After graduating from Rensselaer Polytechnic Institute, he worked in its shops as a special apprentice and machinist; was transferred to the injector department experimental laboratory, and became identified with its injector business, serving successively as foreman, superintendent, and manager before his election as a vice-president in February, 1927. He was the inventor of a number of improvements in the Sellers injector, as well as other devices connected with steam engineering, his latest in-

vention being the Sellers exhaust feedwater heater injector. He was the author of Practice and Theory of the Injector, and a contributor to technical journals on thermodynamics, etc.

RAY M. HUDSON, assistant director of the Bureau of Standards, in charge of the Commercial Standards Group, in a recent report to the director of the Bureau covering the work of the Commercial Standards Group, Division of Simplified Practice, for the period ending September 30, 1928, shows that at the end of the second quarter of this year (June 30), there were 9,754 individual firms and 883 trade associations supporting simplified practice recommendations. At the end of the third quarter (September 30), there were 11,319 individuals and 1,023 trade associations.

T. C. BROWNE of the advertising service department of the *Railway Mechanical Engineer,* has become assistant to the president of the J. S. Coffin Jr. Co., Englewood, N. J. Mr. Browne, in 1916, entered the employ of the Erie as a special apprentice. At the outbreak of the World War he obtained a leave of absence and enlisted in the Twenty-First Engineers, which operated light railway units from railheads to the front lines. Upon his return from France he re-entered the service of the Erie and served consecutively as machinist, piece work checker, foreman, resident inspector and schedule engineer. In 1925 he resigned to go with the *Railway Mechanical Engineer* in its advertising service department.

T. C. Browne

J. SNOWDEN BELL, engineer and patent attorney specializing in the railway field, died on November 27 at his home in Brooklyn, N. Y. Mr. Bell was born at Philadelphia, Pa., on July 11, 1843, and received his early education at Central High School, that city, and the Polytechnic College, State of Pennsylvania, later being graduated from the University of Pennsylvania with an L.L.B. degree. During the Civil War Mr. Bell served in the navy as a marine engineer, and afterward became identified with the mechanical staff of the Baltimore & Ohio, serving as chief draftsman at its Mt. Clare shops. Leaving this latter position he assisted in the organization of the Pittsburgh Locomotive Works and here also served as chief draftsman. Mr. Bell next took up the practice of law as a patent attorney in Pittsburgh, specializing particularly in the railway field. In connection with this latter practice he came to New York about 25 years ago and was actively engaged until within a few months of his death. He was associated with the American Locomotive Company as patent counsel and was the author of "Bell on Expert Testimony" as well as several technical papers and reports.

J. Snowden Bell

Personal Mention

General

LAWRENCE RICHARDSON, mechanical superintendent of the Boston & Maine at Boston, Mass., has been appointed chief mechanical officer. The position of mechanical superintendent has been abolished.

DAVID C. REID, superintendent of locomotive maintenance of the Boston & Maine at Boston, Mass., has been appointed assistant chief mechanical officer. The position of superintendent of locomotive maintenance has been abolished.

O. S. JACKSON, superintendent of motive power and machinery of the Union Pacific at Omaha, Neb., has been promoted to the newly created position of general superintendent of motive power and machinery of the Union Pacific System with headquarters at the same point. Mr. Jackson was born on a farm near Huntington, Ind., in 1875 and, at the age of 14 years, entered railway service as a water boy on a railroad that is now a part of the Cleveland, Cincinnati, Chicago & St. Louis. Later he became a section hand on the Big Four and then entered the mechanical department of the Erie at Huntington. From 1897 to 1905 Mr. Jackson served in various positions in the mechanical department of the Big Four, then being appointed general foreman on the Chicago, Indianapolis & Louisville. In 1909 he was promoted to master mechanic at Lafayette, Ind., where he remained until 1913, when he was appointed superintendent of motive power of the Chicago, Terre Haute & South Eastern (now a part of the Chicago Milwaukee, St. Paul & Pacific), with headquarters at Terre Haute, Ind. In the following year he was promoted to general superintendent in charge of both the mechanical and transportation departments, with the same headquarters. Mr. Jackson entered Union Pacific service in September, 1921, as assistant superintendent of motive power and machinery, with headquarters at Omaha, and was promoted to superintendent of motive power and machinery in June, 1923.

O. S. Jackson

JAMES A. ANDERSON, who has been promoted to assistant superintendent of motive power of the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Milwaukee, Wis., was born at Deals Island, Md., on July 9, 1883. He graduated from Maryland State College in 1904 with the degree of mechanical engineer and entered railway service in August of the same year as a special apprentice at the Mt. Clare shops of the Baltimore & Ohio at Baltimore, Md. After completing the apprentice course, Mr. Anderson was employed in the B. & O. test department, entering the shops at Garrett, Ind., as a machinist in March, 1907. Later he served as assistant foreman and enginehouse foreman at that point and in 1909 was advanced to general foreman of the locomotive and car departments at Holloway, Ohio, where he remained until 1911 when he became motive power inspector of the West Virginia district of the B. & O. From 1912 to 1913 he served as assistant road foreman of engines at Canal Dover, Ohio, and as assistant trainmaster. He was then promoted to master mechanic at Lorain, Ohio, later being transferred to Grafton, W.

Va., and Benwood. He was further promoted to assistant superintendent of the Baltimore & Ohio shops at Pittsburgh, Pa., in 1919, and on February 1, 1920, was appointed superintendent of the Milwaukee shops of the Milwaukee. His promotion to assistant superintendent of motive power in charge of shops and machinery for the system became effective on November 15.

J. W. BURNETT, assistant superintendent of motive power and machinery of the Union Pacific, has been appointed superintendent of motive power and machinery, with headquarters at Omaha, Nebr., succeeding O. S. Jackson. Mr. Burnett has been in Union Pacific service for more than 16 years. He was born at McCook, Neb., in 1890 and obtained his first railway experience as a steam hammer operator in the shops of the Chicago, Burlington & Quincy at that point in 1905. Seven years later he became a machinist apprentice on the Union Pacific at Cheyenne, Wyo., being advanced to foreman at Kearney, Neb., in 1913, general foreman at Grand Island, Neb., in 1917, district foreman at Laramie, Wyo., in 1921 and to master mechanic at Green River, Wyo., in 1922. In the latter year he was transferred to Cheyenne, being promoted to assistant superintendent of motive power and machinery at Omaha in August, 1928.

J. W. Burnett

Master Mechanics and Road Foremen

LOUIS METZGER, general inspector of the Erie at Hornell, N. Y., has been appointed assistant master mechanic of the Wyoming division, with headquarters at Avoca, Pa., succeeding J. F. Kane.

JOHN F. KANE, assistant master mechanic of the Erie, with headquarters at Avoca, Pa., has been appointed master mechanic, in charge of the Jefferson and Wyoming divisions and the Binghamton and Elmira terminals, with headquarters at Susquehanna, Pa., succeeding John Todd, resigned.

Shop and Enginehouse

FRANK A. BEYER has retired from active railway service as superintendent of the west shops of the St. Louis-San Francisco, with headquarters at Springfield, Mo.

Car Department

HENRY KECKONEN, car foreman of the Duluth, South Shore & Atlantic and Mineral Range, has been promoted to the position of general car foreman, with headquarters at Marquette, Mich. The position of master car builder has been abolished.

Purchases and Stores

C. A. RICE has been appointed storekeeper of the Chesapeake & Ohio, with headquarters at Cane Fork, W. Va.

C. S. WETHERHOLT, storekeeper of the Chesapeake & Ohio at Cane Fork, W. Va., has been transferred in the same capacity to Thurmond, W. Va.

R. M. TAYLOR, storekeeper of the Chesapeake & Ohio at Boston, Ind., has been transferred in the same capacity to Shelby, Ky.

T. M. McKeown, purchasing agent of the Canadian Pacific at Vancouver, B. C., has been appointed assistant general purchasing agent, with headquarters at Montreal, Que.

L. C. CLINKINBEARD has been appointed storekeeper of the Chesapeake & Ohio, with headquarters at Boston, Ind., succeeding R. M. Taylor.

E. J. CLARK, general foreman in the stores department of the Chicago, Burlington & Quincy at Havelock, Neb., has been promoted to storekeeper, with headquarters at Creston, Iowa, succeeding F. M. Phebus, formerly storekeeper, who has been assigned to other duties.

EDWARD T. MONROE has been appointed general purchasing agent of the Buffalo, Rochester & Pittsburgh, with headquarters at Rochester, N. Y. Mr. Monroe was born in 1894 at DuBois, Pa. He entered railway service in June, 1911, as trucker in the storehouse of the Buffalo, Rochester & Pittsburgh at DuBois, Pa., and subsequently served as clerk, stenographer and chief clerk to the general storekeeper at that point and as chief clerk in the purchasing department at Rochester, N. Y., in which capacity he served until his recent appointment as general purchasing agent.

E. N. BENDER, general purchasing agent of the Canadian Pacific, with headquarters at Montreal, has retired from the service of that company after having served 47 years. Mr. Bender was born on October 3, 1858, at Quebec City. He entered railway service on June 4, 1880, as clerk in the stores department of the Quebec, Montreal & Occidental Railway (now a part of the Canadian Pacific). Two years later he was promoted to chief clerk in the purchasing department at Montreal, in which position he served until August, 1899, when he was appointed assistant general purchasing agent. Mr. Bender was promoted to the position of general purchasing agent at Montreal in February, 1902, and he served in that capacity up until the time of his retirement.

E. N. Bender

Obituary

HARRISON B. HODGES, former purchasing agent for the Long Island, died on November 24 at his home in Hollis, L. I. Mr. Hodges retired from railroad service on the Long Island in August, 1922.

QUINCEY P. WALLACE, general foreman in the car department of the Illinois Central at Paducah, Ky., died at a sanatorium in St. Louis, Mo., on November 27 at the age of 53. Mr. Wallace had been general foreman in the car department at Paducah since 1914.

HENRY BITTERS, master car builder of the Duluth, South Shore & Atlantic and Mineral Range since 1901, died at his home at Marquette, Mich., on December 5, death having resulted from injuries received when struck by an automobile on November 25. Mr. Bitters was born in Cassel, Germany, April 4, 1859, and came to the United States in 1865, with his parents. Before entering the service of the Duluth South Shore & Atlantic, he was employed by the Chicago & North Western and, later, by the Chicago, Milwaukee & St. Paul as general car foreman at Green Bay, Wis.